Heating Piping & Air Conditioning

JUNE 1955

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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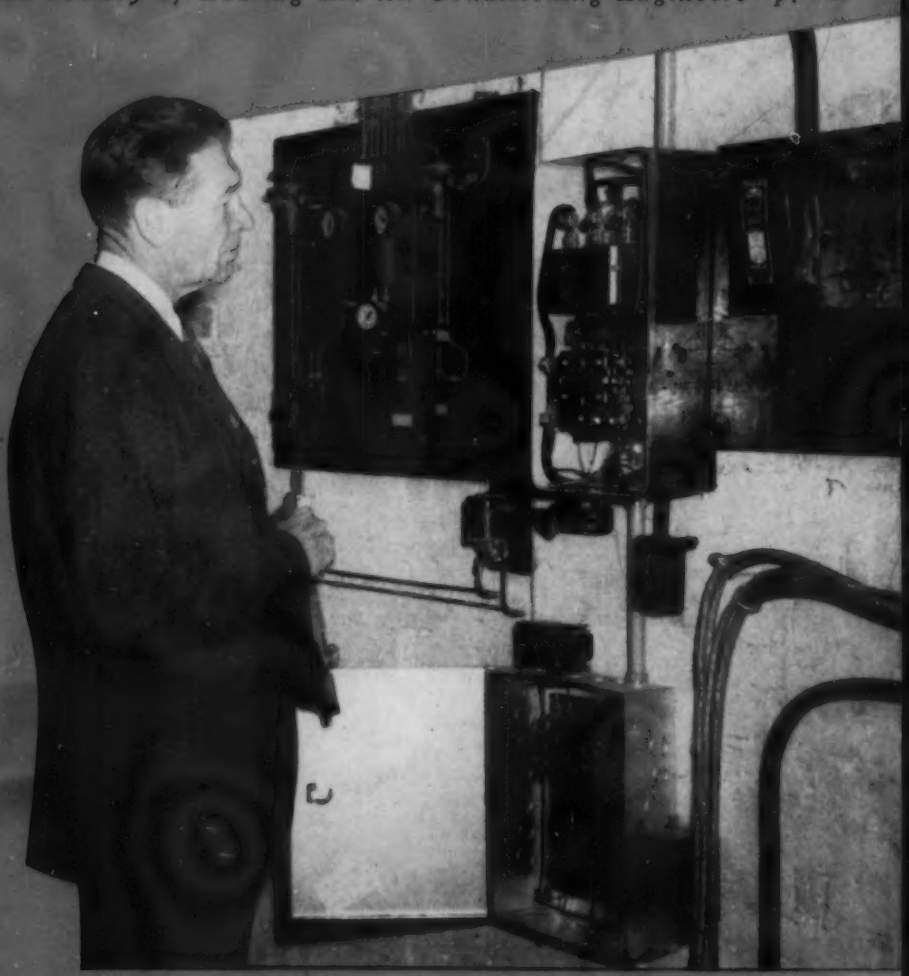
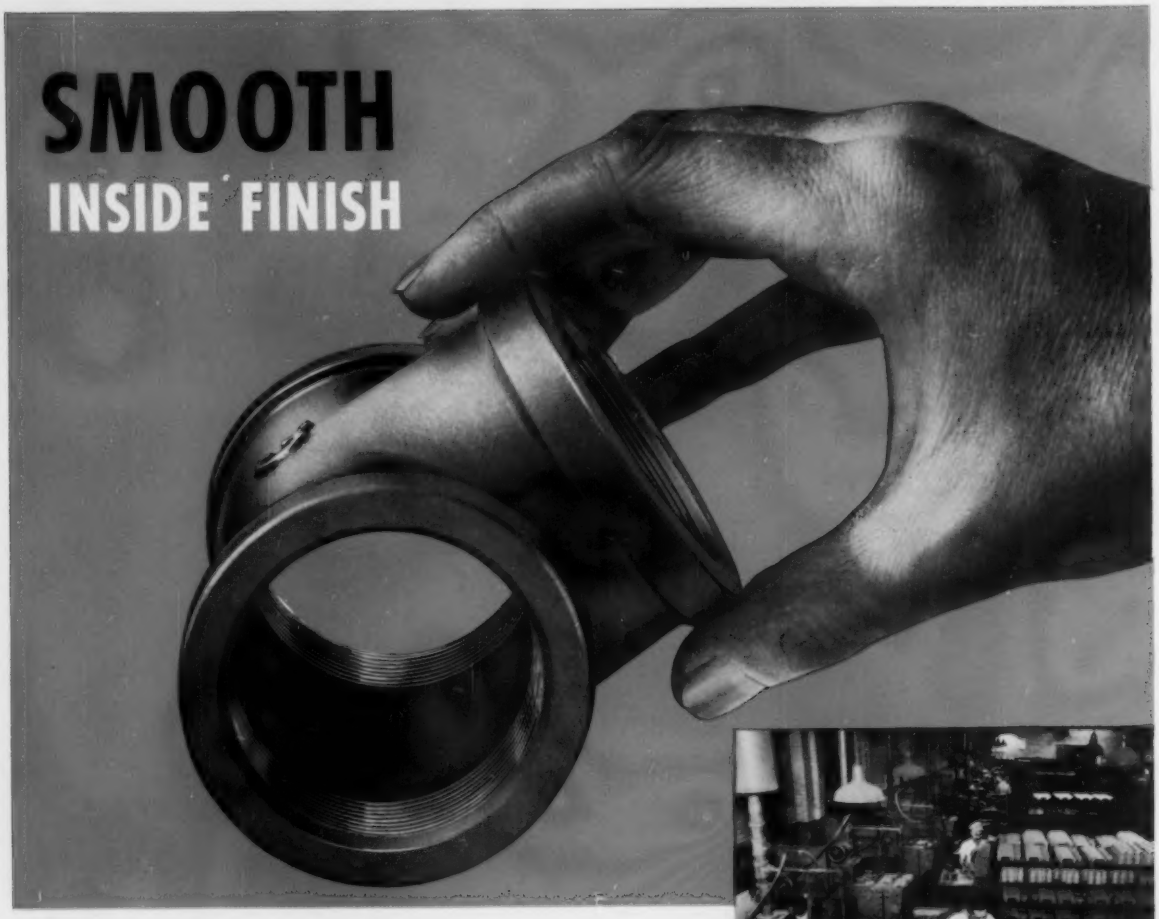


Now central control for the many fans in Chicago's Merchandise Mart will save $16,137 per year, says Operating Manager Walter A. Stahl, here checking the panel in one of the dozens of fan rooms 89

SMOOTH
INSIDE FINISH



Grinnell cores combine the finest materials with expert workmanship.

Modern production methods, finest workmanship...

Typical of Grinnell rigid standards of manufacture is the use of the finest materials in the making of cores. The result is smooth inside surfaces for free flow in piping installations.

High manufacturing standards — plus high quality metal, modern equipment, latest production techniques, and quality control of every step of manufacture, make the complete line of Grinnell Pipe Fittings uniformly reliable.

Whenever you specify Grinnell Cast Iron and Malleable Iron Fittings, you can be sure of —

- **uniform wall thickness**
- **high quality metal, free from sand holes and wall leaks**
- **tested strength**
- **precision threads for easy running up and tight joints**
- **proper chamfer for easy starting and protection of first thread**
- **smooth cores; dimensional accuracy**

Remember, the Grinnell "G" trade-mark is your assurance of the finest in fittings.

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PIPE FITTINGS

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

TO THE RESCUE...

usAIRco installs 10 central station RK's totaling 390 h.p., at Piasecki Helicopter without business interruption!

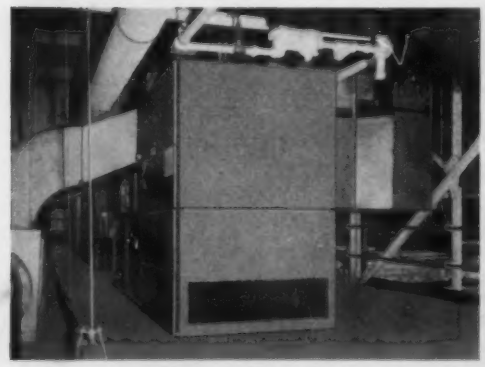
One of the largest integrated air conditioning systems ever installed using factory-assembled packaged central station equipment is in operation at the Piasecki Helicopter Corporation plant in Morton, Penn.

The conditioned area comprises approximately 70,000 square feet, divided into three large areas accommodating the plant's tool design, tool and equipment control, purchasing, accounting, engineering, drafting, cafeteria and reproduction departments.

Each usAIRco RK unit contains, in a single casing, all the elements of a central station packaged air conditioning plant, including built-in evaporative condenser for water recirculation.

The heat load in the conditioned space is unusually high due to low ceilings, virtually continuous lighting fixtures and the heavy concentration of personnel. The cooling season is approximately eight months per year, since heating is not required until outside air is 55 degrees F. or lower. Seven units are inoperative during the winter when existing space heaters, tied into the duct system, furnish fresh, tempered air. The three penthouse units, however, operate year-'round, with tempering accomplished by the use of conventional finned heating coils in the various branch ducts.

The system was designed by Charles S. Leopold, consulting engineer for the Piasecki Corporation, which was represented by W. F. Swartz, plant engineer, and J. E. Weber, plant facilities supervisor. The usAIRco representative is Malloy & Company, Paoli, Pennsylvania.



On a specially constructed concrete platform supported by steel gridwork are 7 usAIRco RK units. Conditioned air goes through wall, left, to ductwork above suspended ceiling in adjoining area.

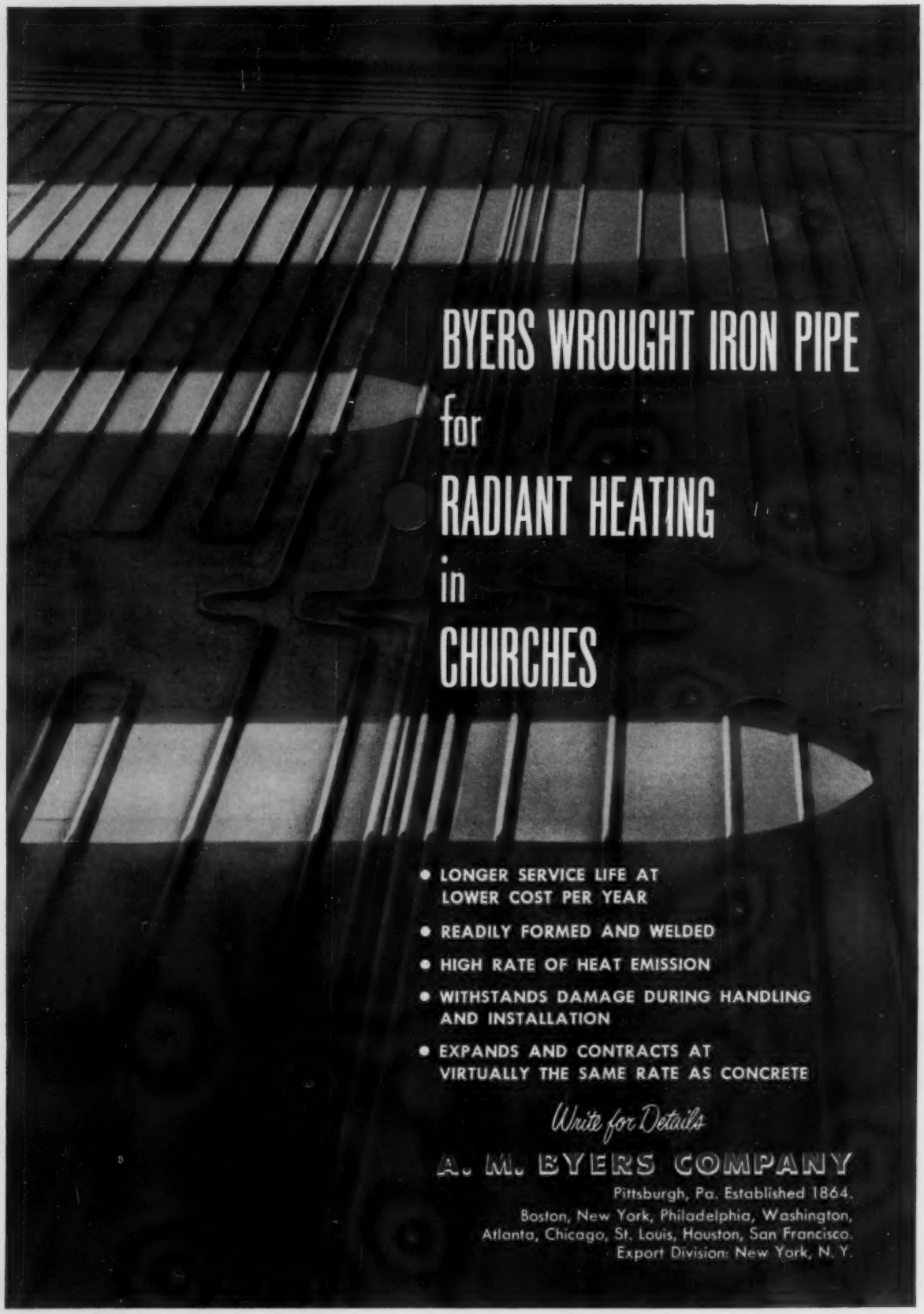
Three usAIRco RK units are mounted in roof penthouses, shown here during construction. Supply air is delivered to nearby conditioned area through ducts. Units operate all year, with tempering through use of finned heating coils in branch ducts.

For further details, write R. A. McLain

UNITED STATES AIR CONDITIONING CORPORATION

Minneapolis 14, Minnesota • Export Dept.: 13 E. 40th St., New York 16, N. Y., U. S. A.

usAIRco
30 YEARS OF AIR CONDITIONING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Heating Piping & Air Conditioning

Vol. 27 No. 6

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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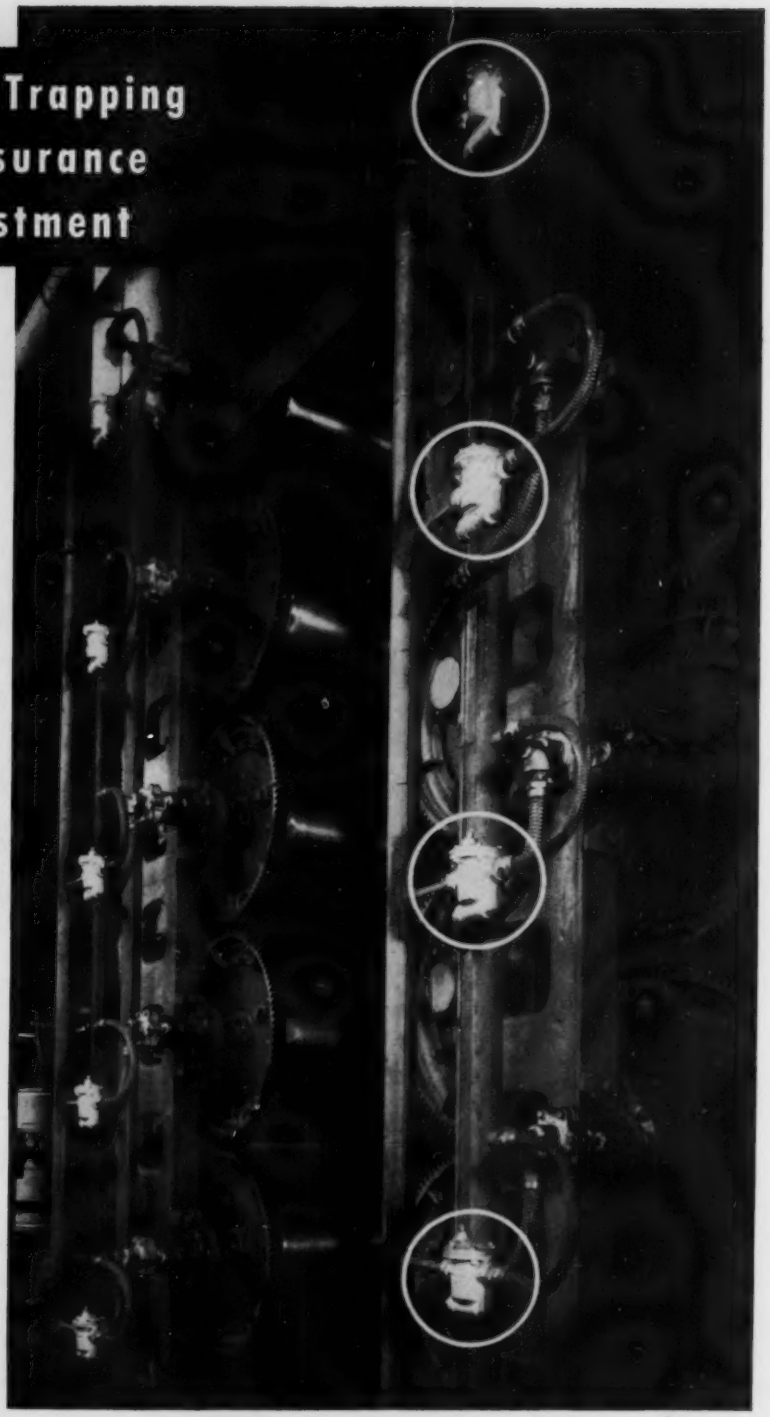
Armstrong Unit Trapping —Low Cost Insurance of a Big Investment



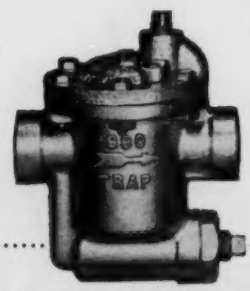
● *30% more production from kettles . . . 84 degrees higher dryer temperatures . . . 8% more output from dry kiln*—these are typical results of unit trapping with Armstrongs.

What about your plant? It doesn't make good business sense to spend $500, $5000 or $50,000 for equipment and then lose 10% to 30% or more of its productivity for lack of proper trapping.

Armstrong traps are "application engineered" by men who know trapping thoroughly—how to size traps for fast heat-up and top temperatures . . . correct installation practice . . . steam supply and return line requirements . . . variable pressure problems . . . mysterious difficulties. The cost of retrapping with Armstrongs is usually but a fraction of 1% of the cost of the equipment drained — *low cost insurance of a big investment!*

Call your Armstrong Representative today. He sells on a basis of "satisfaction or your money back." Or, write:

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Mich.



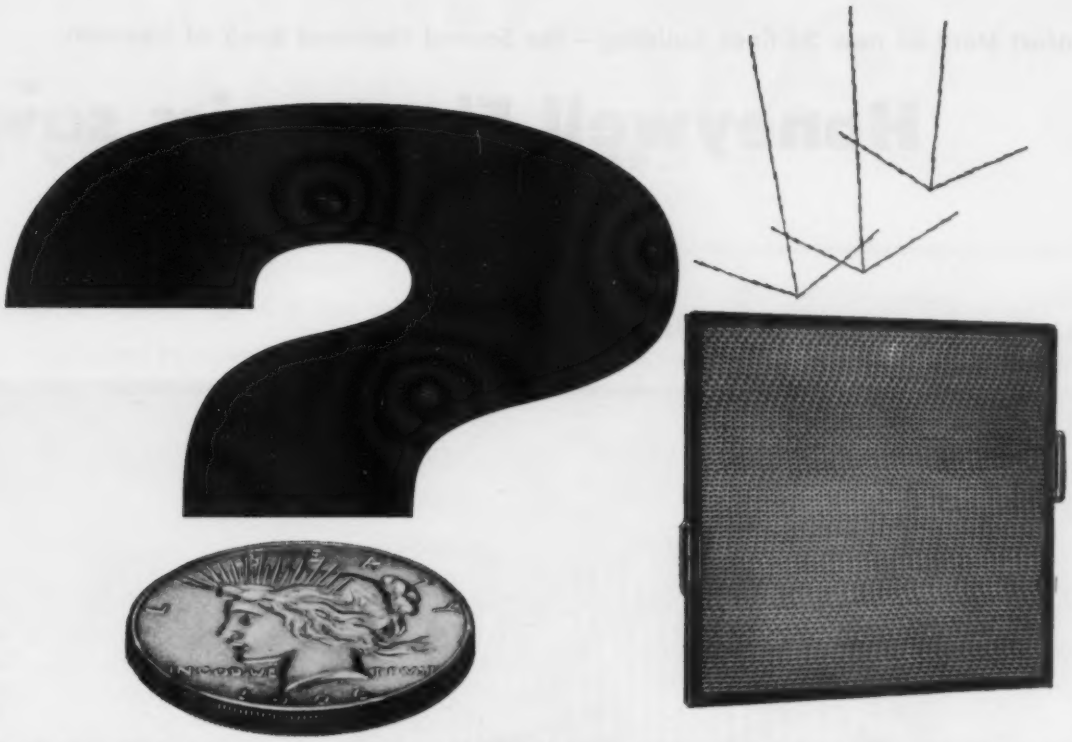
Armstrong built-in strainer traps, pictured on textile dry cans at the right, cost less to buy and install than standard traps and separate strainers—they reduce maintenance and costly shutdowns. Three sizes, ½" or ¾" connections.

SEND FOR FREE STEAM TRAP BOOK . . .

. . . 44 pages of how-to-do-it data. Useful and educational. Free on request without obligation.

S45

ARMSTRONG STEAM TRAPS



HOW MUCH DO YOUR SAVINGS COST?

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With the high cost of building today, it's natural to cut corners wherever practical. But there's one step where it doesn't pay to save . . . and that's in the selection of air filters.

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Consider the economics. About $200.00 invested in filters generally suffices for the average office building, church, school, etc., budgeted at $200,000.00 . . . less than 1/10 of 1%! For a few dollars more you can buy the right type Far-Air filter to fit the job and be sure of **cleaner** air, **longer** service life and **lower** maintenance costs **for many years.**

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Comfort story of new 24-floor building—the Second National Bank of Houston

Honeywell Electronics saves

The Second National Bank building of Houston, now under construction, will have the world's most advanced temperature control system—Honeywell electronic.

thousands of dollars

Central control room is key to more efficient temperature control

THE NEW ERA of electronic efficiency and comfort is coming of age in the southwest. Completion of the new home of the Second National Bank of Houston sometime next year will mark an important step in this era.

The reason for the new efficiency in the Second National Bank is the master control center. Here, a single operator has at his finger tips control over temperatures throughout the 24-story building.

The reason for the new comfort is the flexibility and fast response of the electronic controls. The purpose is to create for the client a more productive environment where people feel, think, and work more energetically and efficiently.

Strategically placed Honeywell thermostats will compensate for every possible occupany, exposure and use comfort factor. The thermostats concealed in ducts will control 318 individual comfort zones, making the new building super-comfortable for employees, clients and tenants.

The *techniques* used in solving these comfort problems can help you provide the Indoor Weather required for your clients' facilities—for a Honeywell Electronic Customized Temperature Control installation is *designed to fit the needs of the building and its occupants.*

For comfortable, more productive temperature in new or existing buildings—of any size—specify Honeywell Electronic Temperature Control

Whether it's a bank, office, church, school, motel, hospital, factory—any building of any size—new or existing, flexible Honeywell Electronic Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Your clients have more comfort, efficiency and maintenance economy—and they'll save fuel, too.

For full facts on Honeywell Electronic Customized Temperature Control, and the economical Honeywell Periodic Maintenance Plan, call your Honeywell Office. Or write Honeywell, Dept. HA-6-76, Minneapolis 8, Minnesota.

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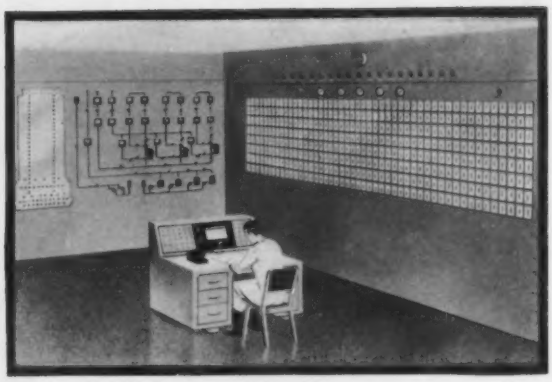

Master Control Center gives quick service to tenants and reduces daily building operating costs.

Proudly displayed before the public on the first floor of the building will be the master control center. The Colorgraphic panel at the rear shows at a glance and records the operating conditions of the basic heating and air conditioning plant, to insure peak efficiency and economy.

A single operator can maintain complete control over the entire heating and cooling system. On his desk, he can read the temperature at 318 key points throughout the building. At the panel on the right, he can adjust any of these temperatures to suit the individual's exact requirements. Ventilation in any area can also be adjusted for maximum economy and comfort.

With this master control center, maximum service is given to the building occupants at a minimum cost. Many thousands of dollars are saved by eliminating trips through the building to check temperatures and adjust thermostats. Only Honeywell can provide this coordinated electronic control and recording system.

Without Honeywell Electronic Control, 318 check points

318 points would have to be checked at the thermostat.

With Honeywell Electronic Control, 1 check point

An operator at a panel will be able to check and *adjust* all 318 remotely.

MINNEAPOLIS
Honeywell

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112 offices across the nation

THE BIGGEST

Announcing

THE LQ600 VALVE

ANOTHER LUNKENHEIMER "FIRST"

. . . the revolutionary new bronze valve which has broken all existing performance records!

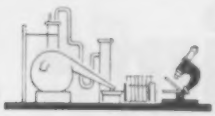
LUNKENHEIMER THANKS ALL OF THE LEADING COMPANIES WHO COOPERATED IN THE FOUR-YEAR LQ600 FIELD TESTING PROGRAM

The LQ600 Valve has been tested for four years in carefully chosen "problem installations" in American industry. *Despite the poor records of previous valves, there was not one single reported case of failure or leakage of an LQ600 Valve!* Here are a few typical records:

LUNKEN

THE ONE *Great*

BRONZE VALVE NEWS IN 50 YEARS!



This revolutionary bronze globe valve has set completely new performance standards in the most severe service in industry!

LQ600 gives you so much *more* service per dollar that you can't afford to continue using bronze globe valves that require constant repair and replacement!

Valve users, cooperating in a four-year testing program, were unable to find *any* service tough enough to wear out an LQ600 — or cause it to leak, even in the most severe throttling installations! This new valve is an investment — one that pays cash dividends in maintenance savings year after year!

BRINALLOY* SEATS AND DISCS make these remarkable performance records possible. This exclusive new Lunkenheimer alloy is far more resistant to wear and corrosion than 500 Brinell Stainless Steel — even outwears case hardened Stainless Steel exceeding 1000 Brinell! There is no need for renewability. *No LQ600 Valve in four years service has required maintenance.*

OTHER FEATURES — a streamlined new exterior . . . the famous Stemalloy® Stem, which far outlasts any other stem material . . . the cool, easy-to-grip Non-Slip® patented handwheel . . . durable, high-strength bronze in body and bonnet . . . and true back-seating, permitting safe and easy repacking under pressure.

*Patented alloy. Trade Mark, The Lunkenheimer Co.

For more information, call your local Lunkenheimer Distributor or write The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

TYPE OF SERVICE	LIFE OF OTHER VALVES	USER COMMENT
125 lb. hose steaming	2 wks. to 2 mos.	Toughest service, previous valves leaked.
Water col. blowdown	2 mos.	Plug valves couldn't take it.
185 lb. steam blowdown	1 yr.	Plug valves failed every year.
125 lb. steam blowdown	"Short"	Previous valve leaked every run.
200 lb. steam—water col. blowdown	2 mos.	Previous valves failed by wiredrawing.
Throttling syrup 140°F.	"Short"	Previous valves cut.
150 lb. throttling 380°F.	6 mos.	Plug valves failed regularly.
100 lb. throttling	2 wks. to several mos.	Plug valves couldn't hold up.
130 lb. throttling	8 mos.	Composition seat valves unsatisfactory.
110 lb. throttling steam	3 wks. to 3 mos.	Three other kinds failed.
Scaled hot water line	"Short"	About all makes used—none held up.
125 lb. throttling steam	6 to 12 mos.	Plug valves failed by wiredrawing.
150 lb. steam—scale present	"Short"	Previous valves broke.
150 lb. throttling steam	4 to 5 mos.	Other makes failed by wiredrawing.

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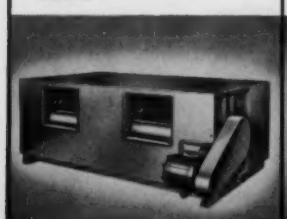
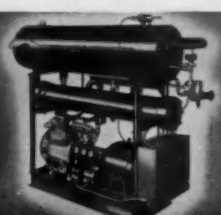
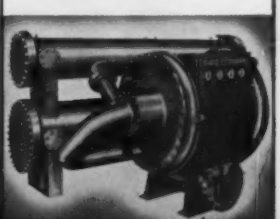


NEW model UniTrane Units. Room air conditioners that give personalized control of climate. Motor-fan type. Filters *all* the air.

Cold Generator, factory-assembled water chiller, comes ready to hook up to power, water. 10 to 100 tons.



CenTraVac, hermetic centrifugal water chiller, automatically modulates from 100 to 10% of capacity. 40 to 400 tons.



stays young years longer!

. . . because it's engineered by Trane, built by Trane, with all these advanced features

Long after the ordinary reciprocating compressor shows its age, you'll find your TRANE Compressor still young and healthy—doing its job efficiently, quietly, without a murmur of complaint.

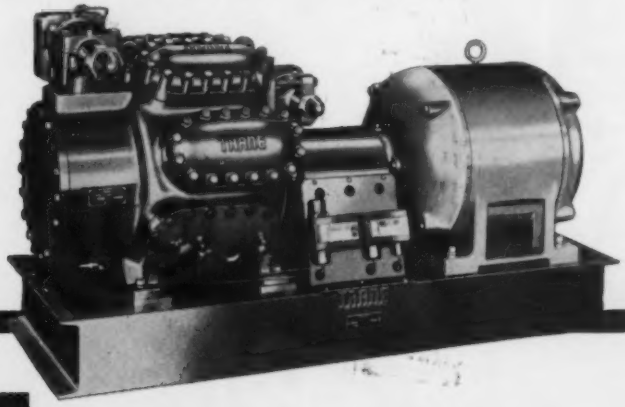
In fact, laboratory endurance tests and field performance indicate you can expect this *modern* machine to give you double the life of the average reciprocating compressor.

And it's easy to understand why, when you see how TRANE engineers have given you *all* the advanced features of this type of machine in *one* compressor—for efficiency, easy maintenance, lowest over-all cost.

Features that help the TRANE Compressor keep its youth...

- *Dependable, multi-step capacity control that reduces starting and stopping . . . saving dollars in power costs, adding years to life.*
- *Thorough multi-cleaning of oil . . . twice filtered, centrifuged, passed over three magnetic plugs.*
- *Reversible oil pump three times needed capacity. Fail-proof oil pressure protection switch.*
- *Exclusive cadmium-plated valves that last up to 800% longer than ordinary steel valves.*
- *Exclusive "valve silencers," cushioned stops in discharge valve cage that muffle metallic "ping" of opening valves.*
- *Spring-loaded safety head that guards against liquid slug damage.*
- *Precision-made, lightweight aluminum pistons and connecting rods for smoother operation.*
- *Aluminum connecting rods provide bearing surfaces without inserts for accuracy of fit, to minimize wear.*

All these—all modern features—are yours only in the TRANE Reciprocating Compressor, the compressor that stays young years longer. For complete information, see your nearest TRANE Sales Office or write TRANE, La Crosse, Wisconsin.



8-cylinder model shown. Capacities 10 to 50 tons. In duplex models to 100 tons.

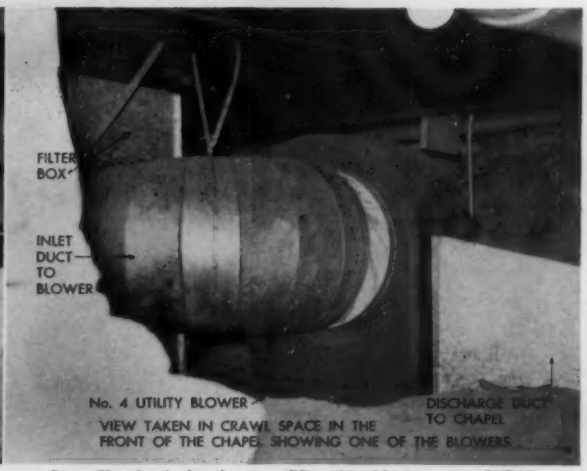
TRANE

MANUFACTURING ENGINEERS

One source, one responsibility for:
Air Conditioning • Heating • Ventilating
Heat Transfer Equipment

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian offices

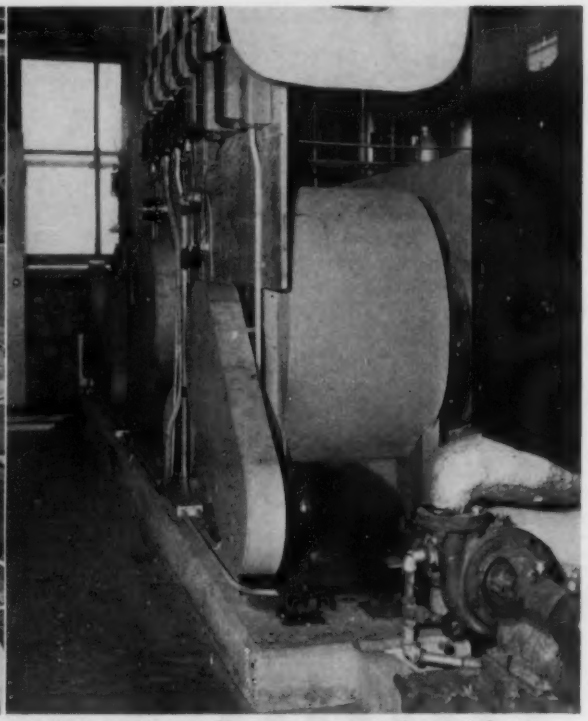
Heat and moisture created by steaming and drying operations in this knitting mill are reduced with 15 Peerless PVS-18 Exhaust Fans. Paint damage was eliminated and plant efficiency was improved.


FILTER BOX
INLET DUCT TO BLOWER
No. 4 UTILITY BLOWER
DISCHARGE DUCT TO CHAPEL
VIEW TAKEN IN CRAWL SPACE IN THE FRONT OF THE CHAPEL SHOWING ONE OF THE BLOWERS

At a Cleveland church, two 4BD utility blowers, two PVS-16 and one PVS-24 exhaust fans create a flexible cooling system during services. The system produces a complete change of air every 5 minutes.

AIR MOVING PROBLEMS SOLVED WITH FANS AND BLOWERS

Peerless Blowers are the heart of the air moving equipment in this modern Veteran's Administration Hospital at Wilkes Barre, Pa. To insure maximum quiet, all units are mounted in the basement.



These four Peerless Blowers are an integral part of the air conditioning equipment at a modern Chicago Hospital. They deliver air to operating, examining and X-ray rooms. Four No. 3½ blowers are used for exhaust purposes.

FAN AND

THE PEERLESS ELECTRIC COMPANY

FANS · BLOWERS · ELECTRIC MOTORS

● Sound engineering and top-quality construction help cut installation costs and eliminate expensive call backs wherever Peerless Electric fans or blowers are specified and installed.

Peerless products are engineered from start to finish for trouble-free performance. Peerless Electric is one of the few fan and blower manufacturers to produce its own motors. The result is job-matched

PEERLESS ELECTRIC

motors that deliver the ratings listed and guaranteed by Peerless Electric. Peerless accuracy permits you to specify and install the proper sized fan or blower. There's no need to pick the next bigger size for insurance. You bid lower and land more jobs.

The clincher on any air moving job is a well engineered installation. To insure complete customer satisfaction and help you make more sales, Peerless gives you any engineering aid you require. A letter or phone call to Peerless Electric or your nearest respresentative will be handled quickly.

If you are installing fans or blowers, you should have both Peerless Electric catalogs—SDA-160 and SDA-200. Write for them today. They're your guide to bigger profits in the booming air moving market.

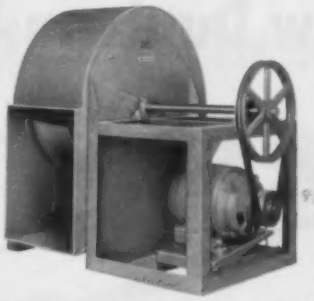
GUARANTEED RATINGS

Peerless® Electric

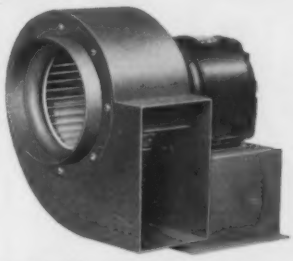
BLOWER DIVISION

1409 W. MARKET ST. • WARREN, OHIO

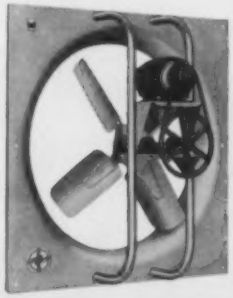
• ELECTRONIC EQUIPMENT



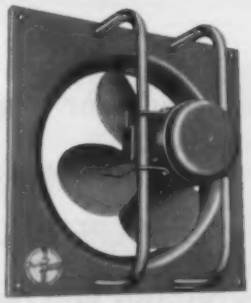
NON-OVERLOADING BELT DRIVE UTILITY BLOWER—Sizes from 12½" to 36½"; 686 to 26,044 CFM. Quiet operation. Motors built and job-matched by Peerless.



DIRECT DRIVE UTILITY BLOWER—Sizes 4½" thru 12". Job-matched Peerless motors; clockwise rotation. Compact, easy to mount. Quiet operation. Ideal for use with ducts.

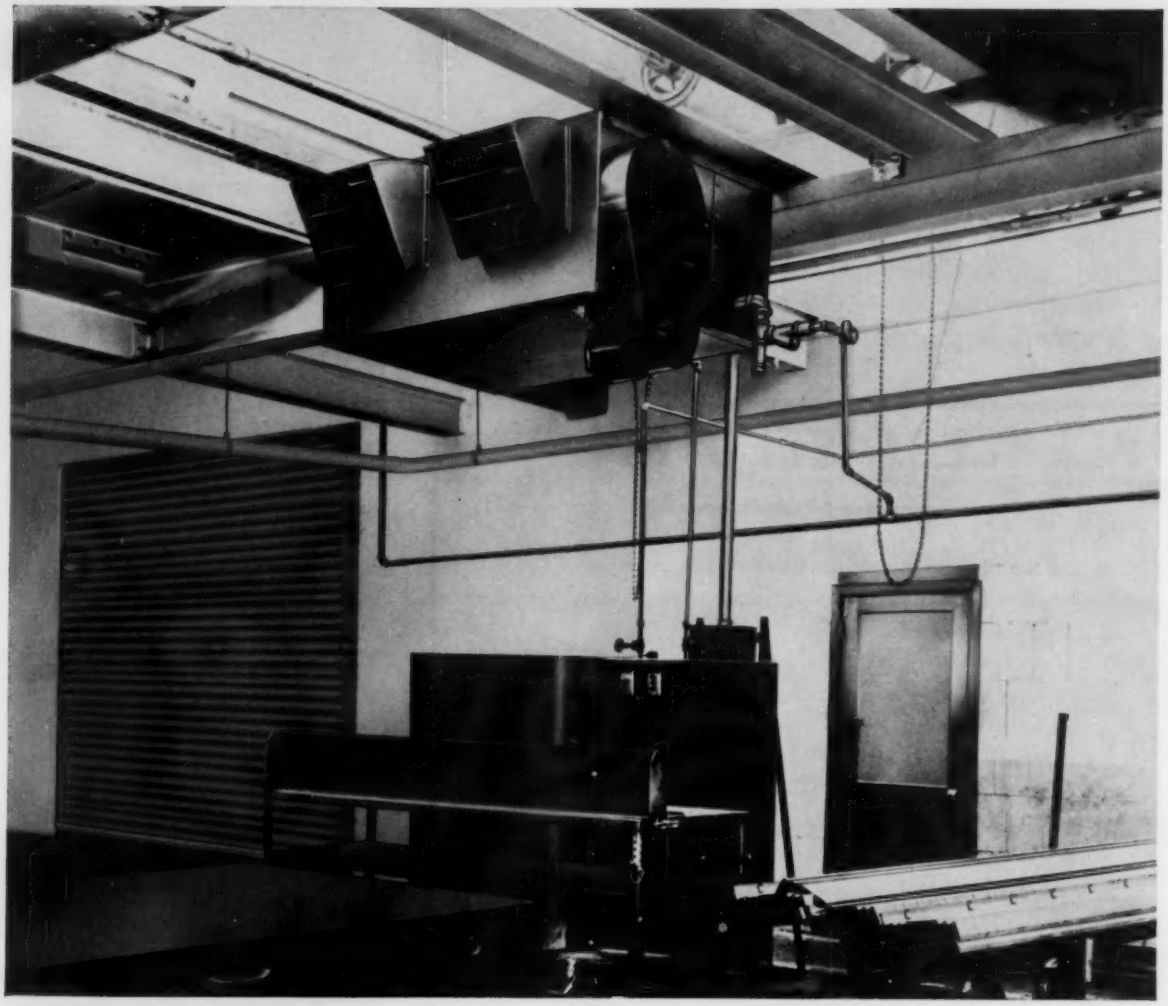


TYPE PVB INDUSTRIAL EXHAUST FAN—24", 30", 36", 42" and 48" sizes. Totally enclosed ball bearing motors. For duty in extreme dust and humidity. Vertical or horizontal mounting.



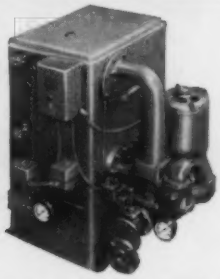
TYPE PVS EXHAUST FAN—CFM ratings from 2,150 to 8,800. Single or two-speed control. Totally enclosed motor. Mounts vertically or horizontally with 4 or 6 lag screws.

New Dunham **Blower Unit Heaters...**



From radiator traps
to fully engineered systems
you can DEPEND ON DUNHAM for
everything you need in heating

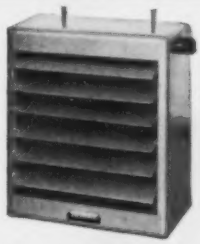
Dunham Radiator Valves. Complete line of radiator valves, traps and other specialties for steam heating.



Dunham Vacuum Heating Pumps. Single and Duplex models. No close clearance parts. Only one moving element.

in types and capacities to fit every need

Dunham Cabinet Unit Heaters for steam or hot water, capacities from 10,000 to 108,000 BTU.



Dunham Horizontal Discharge Unit Heater, for steam or hot water, capacities from 10,600 to 360,000 BTU.

Dunham Vertical Discharge Unit Heater, for steam or hot water, capacities from 26,000 to 576,000 BTU.

Dunham's newly redesigned line of blower unit heaters is one of the most broad and complete in the industry. Seventeen different sizes . . . in 170 ratings from 125,000 to 1,500,000 BTU . . . 1,430 to 20,800 CFM.

Dunham Blower Unit Heaters can be mounted on ceilings, walls or on floors. They solve any heating, ventilating, air cleaning, process heating or drying problem. A wide variety of nozzle and nozzle-extension arrangements lets you "pinpoint" or widely diffuse warmth where needed. Heaters can be used with or without ducts . . . with bypass damper, filter section and mixing dampers to handle any of your client's usual . . . or unusual . . . space or process heating and ventilating requirements.

And For Spot Heating, Dunham offers an unusually complete line of propeller fan unit heaters . . . cabinet types for floor- or wall-mounted installations . . . horizontal and vertical discharge heaters for overhead applications. For full information, write for Bulletin HPAC-6, C. A. Dunham Company, 400 W. Madison St., Chicago 6, Illinois.

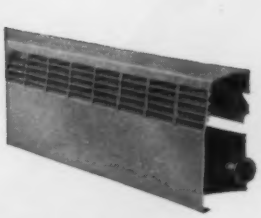
DUNHAM®

HEATING & COOLING EQUIPMENT

RADIATION • CONTROLS • UNIT HEATERS • PUMPS • SPECIALTIES

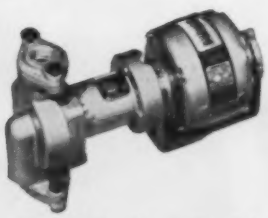
Quality First for Over Fifty Years

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON



Dunham Radiation. Full range of sizes and types of convectors, baseboard and finned tube radiation.

Dunham Unit Heaters. Line includes heating-cooling units, vertical, horizontal discharge and large blower unit heaters.



Dunham Circulators. Heart of Dunham's complete hot water line. Single-spring motor coupling. Brand-name motor.

Dunham Vari-Vac®. Precision temperature control system uses continuous-flow "cool" steam, cuts fuel costs up to 40%.

One reason Westinghouse Air Conditioning lasts longer, and needs less maintenance, is the refrigerant leak-test, shown at left. After manufacture and assembly, every part is thoroughly tested for tightness with a Halide Torch, which changes color at the least trace of escaping gas. The result . . .

12 Years of Top Capacity

AIR CONDITIONING

with unbelievably little maintenance

In 1942, RKO installed a Westinghouse Air Conditioning system in its RKO-Fordham Theater, New York. Since then the installation has provided uninterrupted comfort for millions of RKO customers. Even with its work-load increased by wilting summer crowds, the system has operated regularly, seven days a week, May through October, with unbelievably little maintenance.

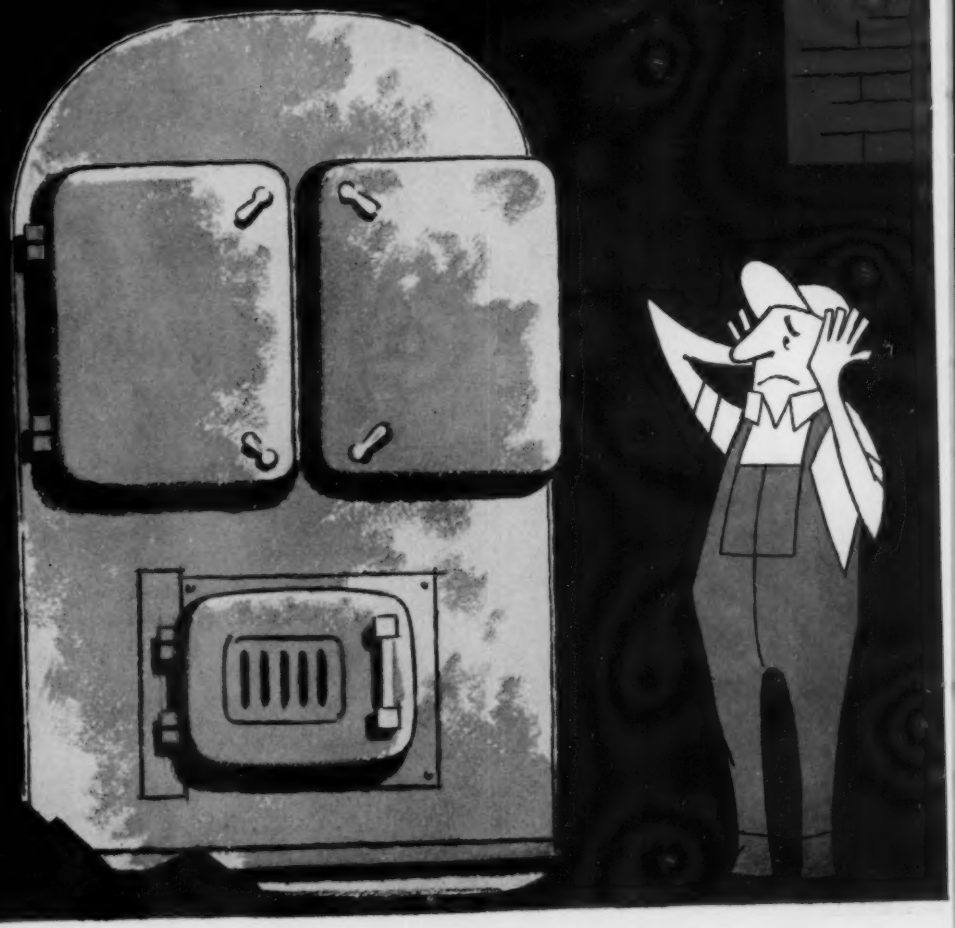
And the two Westinghouse compressors that make up the heart of the system have *never had a breakdown, never been overhauled, never been repaired.* With lubricant sealed in, dirt sealed out, these Westinghouse compressors operate today as efficiently as when they were installed 12 years ago.

HELPFUL GUIDE TO COMPLETE WESTINGHOUSE LINE . . . *Yours for the asking.* To show you at a glance the complete range of Westinghouse equipment, Westinghouse offers a handy reference folder on commercial and industrial air conditioning. Covers Unitaire® package units, heat pumps and components for field-assembled installations. For your free copy, write directly to: *Westinghouse Air Conditioning, Dept. HP-3, Box 510, Staunton, Va.*

YOU CAN BE SURE... IF IT'S **Westinghouse**

J-80482

Are excessive "entry" costs knocking down your replacement volume?



Think how many customers in your area would replace worn-out boilers if it weren't for excessive installation costs. *You can get these jobs* if you

install the unique

SPENCER "LW"

BUILT IN TWO SECTIONS—permits easier entry through narrow basement openings. Avoids costly tearing out of walls. The two water-tight sections can be moved in separately, yet require no welding for installation.

LOWER WATERLINE—overall height of the Spencer "LW" is approximately 25% less than that of conventional firebox boilers...makes possible its use in low-ceilinged basements...saves excavation expense!

LET SPENCER BUILD UP YOUR BOILER BUSINESS — WRITE DEPT. HP-65.

New Spencer "C". Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.

Spencer "A". Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building... for *every* fuel.

SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

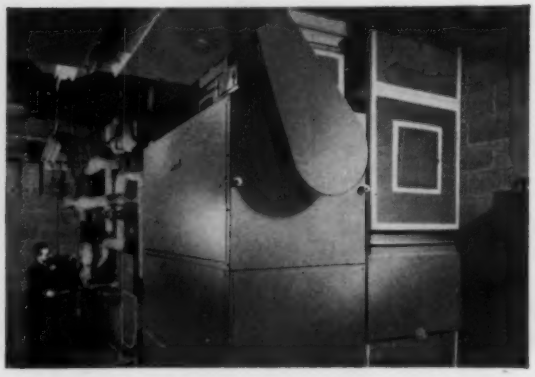
ASME and SBI Approved.

Located in Manhattan, the Port Authority Bus Terminal handles over 2,500 buses daily. Loading and unloading stations are on two levels: one in the basement, one on the third floor. American Blower equipment provides fresh atmosphere throughout the terminal's 11,376,000 cu. ft. of space, including its nearly 90 business locations.

World's largest bus terminal doubles as

Each store proprietor chooses the perfect climate for his business . . . thanks to 90 individual American Blower Air Conditioners. The adaptability of the units allowed horizontal or vertical installation, saved space. In the smaller shops, units are ceiling-suspended and fully enclosed; others are floor-mounted.

To air-condition terminal's bowling alley, American Blower Unit was installed in vertical position. Glenn Gessler, maintenance supervisor, says — "I like American Blower equipment. Periodic cleaning of coils has been the only maintenance required in over four years of operation!"



Two American Blower Ventilating Fans, housed in the tower atop the Port Authority Terminal, exhaust fumes and gases from the basement bus-loading level at up to 150,000 cfm. Giant-sized (about 18 ft. in diameter), they provide a change of air every nine minutes.

complete air-conditioned shopping center

In addition to ventilating huge interior roadways, the Port of New York Authority Bus Terminal uses American Blower equipment to individually air-condition its nearly 90 stores

The Port of New York Authority Bus Terminal is more than the world's largest bus terminal, serving 130,000 commuters a day . . . it's also a complete shopping center with nearly 90 business establishments. Here, you can board a bus, go bowling, or buy almost anything—from a quick snack to a short shave—in ocean-fresh atmosphere supplied by American Blower equipment.

There are two bus-loading levels. One is below ground, where large American Blower Ventilating Fans change the air every nine minutes. The other is on the third floor. During rush periods, as many as 750 buses an hour load and unload. But fumes are no problem.

Each of the business locations, however, has its own climate requirements. The candy store, for instance, needs cool temperatures to keep chocolates firm; the pet shop, with its snakes and tropical fish, requires warmer temperatures. Ninety American Blower Air Conditioners—which individually cool, heat, filter, and dehumidify—enable each proprietor to select the exact climate he wants . . . without recirculating the odors of the other stores.

Every day, more and more people benefit from the efficiencies and economies of American Blower equipment and service. How about *you?* Whether your air-conditioning or ventilating needs are large or small, contact your American Blower Branch Office for friendly, expert assistance. In Canada: Canadian Sirocco Co., Ltd.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

PIN POINTED FOR SERVICE

Youngstown has 28 district sales offices conveniently located throughout the nation to serve you quickly. They are staffed with men who know the steel business thoroughly and are qualified to help you with your steel requirements. You can get quick service whether you write, wire or phone your nearby Youngstown District Sales Office.

QUALITY YOUNGSTOWN SERVICE

DISTRICT SALES OFFICES

Atlanta 1, Ga.
1310 Healey Building
Phone Walnut 5920

Boston 16, Mass.
250 Stuart Street
Phone Liberty 2-5855

Buffalo 2, N. Y.
1508 Liberty Bank Bldg.
Phone Washington 6270

Chicago 2, Illinois
111 W. Washington Street
Phone Franklin 2-5470

Cincinnati 2, Ohio
1302 Carew Tower
Phone Main 1424

Cleveland 13, Ohio
2400 Terminal Tower Bldg.
Phone Main 1-2605

Columbus 15, Ohio
2850 LeVeque Lincoln Tower
Phone Capitol 4-7211

Dallas 2, Texas
1602 First Nat'l. Bank Bldg.
Phone Riverside 9538

Denver 2, Colorado
814 Continental Oil Bldg.
Phone Main 3-2283

Des Moines 9, Iowa
437 Insurance Exchange Bldg.
Phone 3-1265

Detroit 2, Michigan
926 Fisher Bldg.
Phone Trinity 5-5816

Grand Rapids 2, Michigan
604 Michigan Nat'l. Bank Bldg.
Phone 9-4291

Houston 2, Texas
1350 Esperson Bldg.
Phone Fairfax 1325

Indianapolis 4, Indiana
520 Circle Tower
Phone Melrose 2-3461

Kansas City 6, Mo.
1222 Commerce Bldg.
Phone Victor 5837

Los Angeles 15, Calif.
714 W. Olympic Blvd.
Phone Prospect 7581

Milwaukee 3, Wisc.
2110 Wisconsin Tower
Phone Broadway 1-5148

Minneapolis 2, Minn.
1050 Baker Bldg.
Phone ATlantic 2970

New Orleans 12, La.
520 Whitney Bldg.
Phone Raymond 0153

New York 36, New York
500 Fifth Avenue
Phone Lackawanna 4-4340

Philadelphia 2, Pa.
1502 Girard Trust Bldg.
Phone Rittenhouse 6-9830

Pittsburgh 22, Pa.
Two Gateway Center
Phone Atlantic 1-2350

St. Louis 3, Mo.
611 Shell Bldg.
Phone Geneva 6-1223

San Francisco 5, Calif.
55 New Montgomery Street
Phone Garfield 1-6544

Seattle 4, Washington
457 Central Bldg.
Phone Main 6420

Tulsa 3, Oklahoma
1305 Philtower Bldg.
Phone 54-4634

Washington 5, D.C.
327 Bowen Building
Phone Republic 7-2340

Youngstown 1, Ohio
505 Stambaugh Building
Phone Riverside 7-0771

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices: Stambaugh Building - - Youngstown 1, Ohio
Plants: Youngstown, Ohio; Struthers, Ohio; Indiana Harbor, Indiana

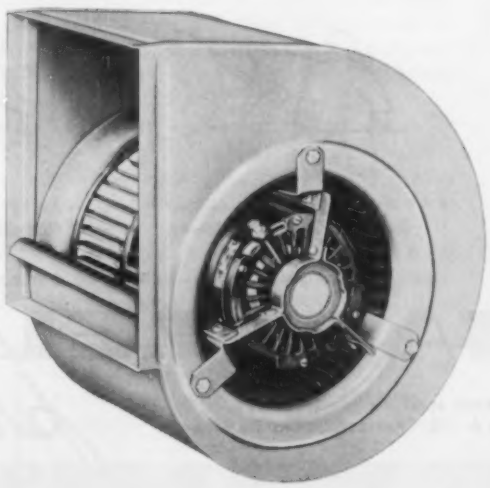
SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

KEEP IT QUIET

Just between us — there's a secret in Utility's new Direct Drive Blower that gives you practically no-sound operation. These blowers are now equipped with neoprene hubs which isolate motor noise and vibration. A simple technique developed by Utility's fine engineering minds — it is included in all direct drive blowers at no advance in cost. The first to utilize this exceptional innovation, Utility is a leader in the kind of high speed production which permits quality performance at a quantity price.

Let your customers in on it — Utility's Direct Drive Blowers keep it quiet and offer many other exclusive features. They are adaptable to the manufacture of heating, cooling, refrigerating and ventilating equipment . . . require less space, have no unnecessary accessories and can be speed-controlled easily. Check Utility for blowers, blower parts or any combination of parts — and discover for yourself . . .

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE



A Division of Utility Appliance Corp.

UTILITY FAN CORPORATION

911 East 59 Street, Los Angeles 1, California

UTILITY

Producers of blowers and blower parts for original equipment manufacturers. Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Write for catalogue data.

Hartzell Vaneaxial Blowers

rugged...

Hartzell vaneaxial blowers are designed and built for long life and trouble-free service in the most punishing industrial applications. All welded construction. Heavy-gauge steel throughout. Spark-proof aluminum impeller. Thousands of successful installations have proved that they've got what it takes.

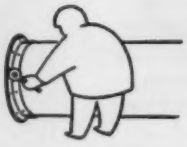
powerful...

The new 54" belt-drive model will deliver 85,800 CFM against ½" static pressure (54.8 BHP) or 54,400 CFM against 7" static pressure (85.9 BHP). That's a powerful blast of air. Complete performance data on all models is included in Bulletin A-110. Mail the coupon below to get your free copy.

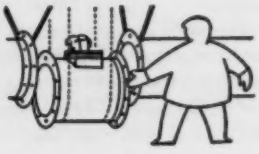
Hartzell Vaneaxial Blowers are available in 10 belt-drive sizes, 12" to 54", and 6 direct-drive sizes 18" to 42". With the new Hartzell High-Temperature Vaneaxial (same sizes, same performance as standard belt-drive models) you can move air at temperatures up to 350° or air containing acids or alkalies without fear of premature failure of belts and bearings.

...and easy to install

Cut out a duct section same length as blower.



Bolt angle-iron flanges to duct ends.



Bolt blower to duct ends just installed, and brace duct flanges.

And that's all—just make electrical connections and you're done.

HARTZELL

propeller fan co.

Div. of Castle Hills Corp.

Dept. V

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

Please send me my free copy of Bulletin A-110, "Hartzell Vaneaxial Blowers."

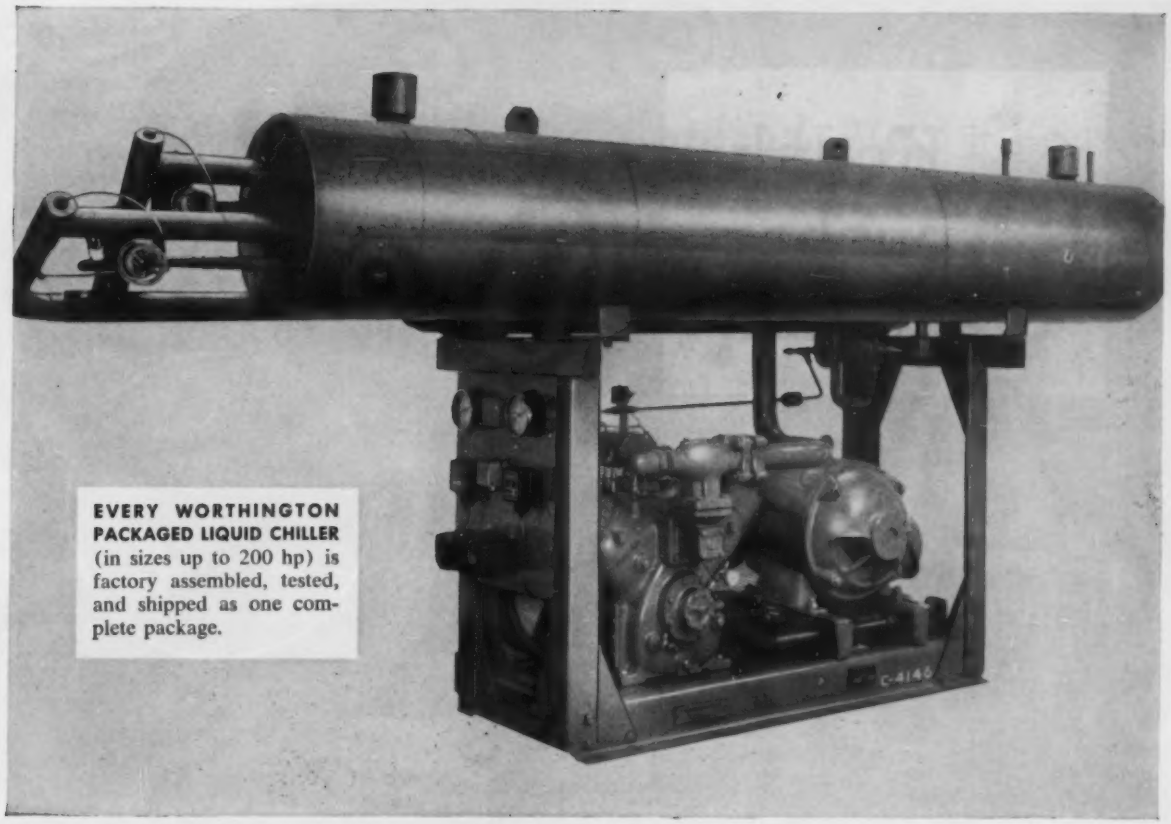
Name _____

Company _____

Street & Number _____

City & State _____

If student, check here for special information ☐



EVERY WORTHINGTON PACKAGED LIQUID CHILLER (in sizes up to 200 hp) is factory assembled, tested, and shipped as one complete package.

Low-cost operation, easy installation . . .

you get both with Worthington's new packaged liquid chiller

If you're interested in process cooling, refrigeration, or air conditioning, take a long look at these six big advantages of the new Worthington packaged liquid chillers:

LOW-COST OPERATION — Simple variable capacity control exactly matches load requirements — results in unusually economical operation.

EASY INSTALLATION — All units are shipped completely assembled. Only simple foundations are needed.

FACTORY ENGINEERING — You benefit from Worthington's undivided manufacturing responsibility. Worthington makes everything — compressor, chiller, drive and controls.

MINIMUM FLOOR SPACE — Efficient, compact design means greatly reduced space requirements.

LONG LIFE — over a million dollars worth of research went into Worthington's Freon compressor — all aimed at making it the most durable unit ever.

WIDE SELECTION — No matter what you want to chill — water or brine — you can get a Worthington packaged liquid chiller that's exactly right for the job. Sizes from 7½ all the way up to 200 hp.

Want more facts? Mail the coupon today for Bulletin C-1100-B52. It tells all about specifications, features, and typical applications. A-3-55-HP

WORTHINGTON

Climate Engineers to Industry, Business and the Home

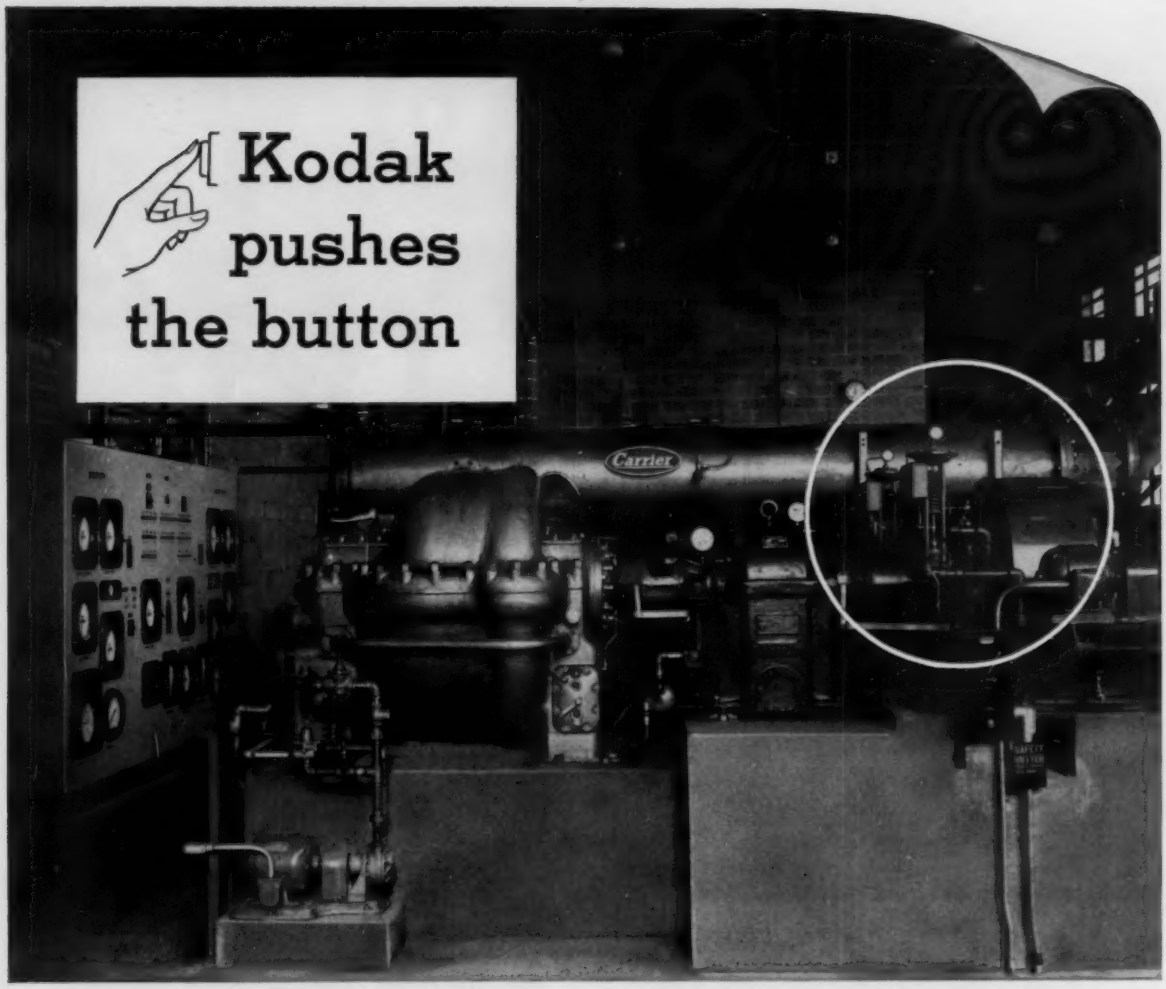
Worthington Corporation
Air Conditioning and Refrigeration Division
Harrison, N.J.

Gentlemen:
Please send me your new Bulletin C-1100-B52 on Worthington Liquid Chillers.

Name_____

Address_____

City_____ Zone____ State_____



We do the rest...

In controlling the refrigeration system at Kodak's huge new distribution Center at Rochester, N. Y.

This center handles practically every Rochester-manufactured Kodak product for storage, packing and shipping in its 476,000 square feet of floor space.

Air conditioning for storage of sensitive photographic films and papers is extremely important, and it starts off right with these 250-ton Carrier centrifugal compressors which supply the chilled brine to the Taylor controlled temperature zones . . . "the most fully automatic compressors we ever installed", say Carrier engineers about these Taylor controlled centrifugals.

Taylor controls keep the output temperature of the chilled brine constant by regulating the oil volume in the hydraulic coupler (circled) between the compressor itself and a constant speed motor. During periods of minimum load, an ingenious hot gas by-pass induces a load on the compressors to eliminate surging and keep the system fully automatic. From Friday night to Monday morning, when the load is especially light, the system automatically keeps the brine temperature constant with *no manual attention whatever.*

No matter what your air conditioning or refrigeration problem may be, you'll get most efficient operation from your equipment when it's under Taylor Control. Ask your Taylor Field Engineer, or write for **Catalog 300.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Crunden Martin Manufacturing Company selects

After blanking the body of garbage cans from flat galvanized sheets, the next step is to edge and corrugate the body sheets. This calls for quality sheets to avoid breakage and flaking.

USS Galvanized Steel Sheets

for severe and intricate forming operations

All the "Sealtite" galvanized ware—including garbage cans—made by the Crunden Martin Mfg. Co., St. Louis, Mo., has two outstanding characteristics. It is guaranteed to meet U.S. Department of Commerce Specifications and it features the famous Gordon Seam that provides extra strength and rigidity while it insures against leakage. To meet the requirements set up by these two important features, Crunden Martin needed a top quality galvanized steel sheet. USS Galvanized Steel Sheets were a natural selection for their "Sealtite" ware.

USS GALVANIZED STEEL SHEETS have four outstanding qualities that make them especially valuable to Crunden Martin, and to you. They have good ductility to take corrugation, seaming (see sketch), beading and drawing. They are produced true to gauge. Their galvanized coating adheres so tightly to the steel base that it does not flake during fabrication, will not rust in service. And finally, USS Galvanized Steel Sheets are made only from top quality steel.

If there's a place in *your* operation for USS Galvanized Steel Sheets, take advantage of all the benefits of this fine product. For more information, ask your sheet distributor or our nearest district sales office, or write direct to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

Here the famous triple-interlocking Gordon Seam—see sketch—is clinched and bumped. This step subjects the galvanized sheet to a most severe forming operation.

The 20-gallon "Sealtite" can, already inspected and labeled, passes through the final step . . . the projection welding of clip and side handles.

UNITED STATES STEEL CORPORATION, PITTSBURGH
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS GALVANIZED STEEL SHEETS

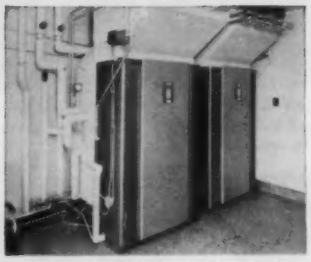
UNITED STATES STEEL

G. E. HAS THE ANSWER TO AIR CONDITIONING PROBLEMS IN ANY STORE, OFFICE, OR FACTORY

One of four operating rooms at Mercy Hospital in Canton, Ohio. These, with sterilizing room, make up five zones that are "comfort serviced" all year 'round by two 5 ton G-E Packaged Air Conditioners.

HOSPITAL AIR CONDITIONS OPERATING ROOMS... SAVES ON EQUIPMENT, DUCTWORK, SPACE

Heat-gain and heat-loss studies showed that 16 tons of air conditioning were required for the four operating rooms, one sterilizing room of Mercy Hospital in Canton, Ohio. But Niagara Heating Co., local G-E contractors, found a way to give the effect of this tonnage with only two 5 ton G-E units—*saved the cost of six tons* by feeding water from the Hospital's own well to a preconditioning coil and then to the G-E units. Duct runs were minimized by locating G-E units in doctors' rest area, handy to operating rooms. Space requirement: only 34 square feet. Larger equipment would have entailed roof installation and much higher costs. Write for data to: General Electric Co., Commercial and Industrial Air Conditioning Dept., 5 Lawrence Street, Bloomfield, N. J.



Simple, space-saving installation. Compact size of G-E units permitted their location in the lounge of the doctors' rest area—no space wasted—no long duct runs.

Safety and sanitation are of paramount importance in installations of this type. It is recommended that the services of a consulting engineer generally be employed in this kind of application.

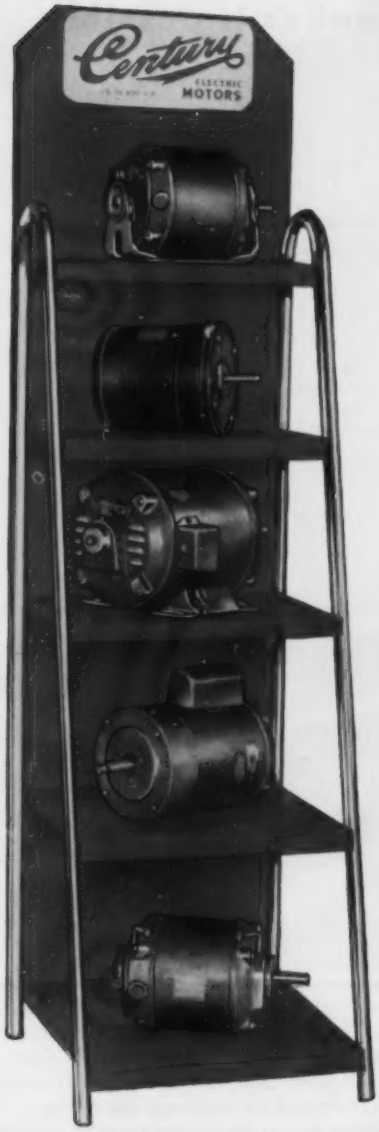
G-E PACKAGED AIR CONDITIONERS OFFER MORE:

- *Low installation, low operating costs.*
- *Gives the architect maximum design freedom. Units can be used in space or concealed, with or without ducts.*
- *Streamlined cabinet styling. Adds to decor of any interior.*
- *3, 5, 7 1/2, 10 and 15 ton units can be used singly or in multiple to meet air conditioning needs of any building.*
- *Easily directed airflow for no-draft, no-waste air circulation.*
- *Muggy Weather Control removes excess moisture in any weather without over-chilling or clammy cooling.*
- *Built and factory assembled by General Electric. 5-year warranty covers entire sealed cooling system.*

Packaged AIR CONDITIONERS

Progress Is Our Most Important Product

GENERAL ELECTRIC



for extra profit... WITHOUT extra work sell Century

REPLACEMENT MOTORS Performance-Rated® for Blower, Pump and Compressor Applications

Think how many of your jobs need new motors. You can cash in on this natural selling opportunity when you stock and sell Century Performance-Rated replacement motors. Century's complete range of size, speed, frame, mounting and torque characteristics helps you give every job precisely the right replacement motor for top performance.

Your nearby Century distributor will be happy to work closely with you to provide ample stock and speedy service.

This handsome, sturdy display stand puts you in the motor business immediately . . . and it requires only a few square feet of floor space. Find out how you can get it FREE with your first assortment of Century Performance-Rated motors

GET FULL DETAILS on this opportunity . . .

Performance-Rated®
1/8 to 400 H. P.

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Offices and Stock Points in Principal Cities

MAIL THIS COUPON TODAY!

CENTURY ELECTRIC COMPANY, 1806 Pine St., St. Louis 3, Missouri

Send me all the facts about Century's Display Stand Motor Selling Plan:

Name.....

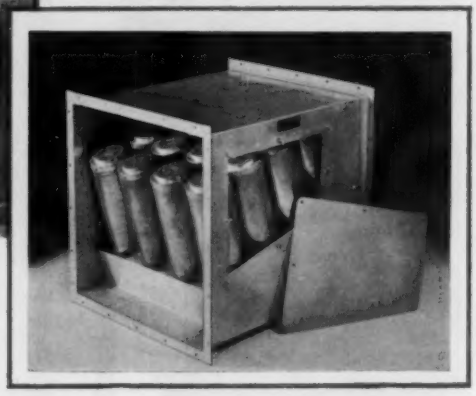
Company.....

Address.....

City..... *State*.....

Traveling crane cab has to be air conditioned
Dorex Air Recovery makes it possible

DOREX installation at Carteret, New Jersey, plant of American Metal Company, Ltd., manufacturers of O.F.H.C. Brand Copper, Electrolytic Copper Powder and Atomized Metal Alloy Powders. Note, at left of crane cab, the Dorex Type H #42 Canisters. These are one of the forms in which Dorex Activated Carbon can be applied to keep air purified and dramatically reduce the amount of outside air that must be taken in.



CLOSE-UP of Dorex Activated Carbon Type H #42 Canisters. Each canister is filled with specially activated carbon granules which adsorb impurities from air passing over them. Dorex reduces by as much as two-thirds the amount of outside air that has to be taken into a system.

This overhead crane cab works in atmosphere highly contaminated by sulphur dioxide and other toxic fumes and gases, plus excessive heat. It *has* to be air conditioned. But the cab travels, and that makes it impractical to hook up an outside ventilating source for all the needed fresh air.

Dorex Air Recovery overcomes this difficulty. Air conditioning units inside the cab are set to use a minimum of outside air and a maximum of recirculated air—both decontaminated through Dorex Activated Carbon in combination with heavy-duty air filters.

As a result, all toxic gases are removed and temperature is maintained at a comfortable level, assuring maximum operator safety and efficiency.

If you have an air conditioning or ventilating problem, let Dorex engineers help you work out the solution. The experience of thousands of Dorex users over the past 25 years shows you'll do a better job at a lower cost. Connor Engineering Corporation, Dept. A-65, Danbury, Connecticut.

CONNOR

dorex®

air recovery

TUBE-TURN

Remember the trademarks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

NEW!

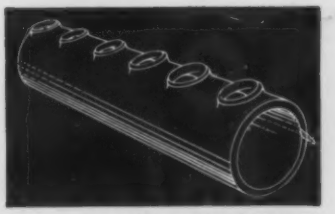
TUBE-TURN Manifold Welding Fitting

simplifies piping construction, reduces costs

TUBE TURNS now offers custom-made Manifold Welding Fittings with size, wall thickness, and number of outlets as required by your service conditions. These manifold fittings are available in all commercial metals and alloys.

Use of TUBE-TURN* Manifold Welding Fittings provides stronger and safer outlet connections than are possible when pads and saddles are employed. This new fitting makes possible greater economy and speed of construction in many types of service. It is particularly useful when outlets are smaller than one-half the run pipe diameter, when they are extremely close together, or when they must vary in size.

This new addition to Tube Turns' line enables you to "specify TUBE-TURN" for all your tee and manifold fitting requirements. For prompt, helpful service, get in touch with your Tube Turns' Distributor. You'll find one in every principal city.



The new TUBE-TURN Manifold Welding Fitting . . . superior to pad and saddle construction . . . easy to install . . . dependable in service.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet *all* U. S. piping code specifications

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

TUBE TURNS

LOUISVILLE 1, KENTUCKY

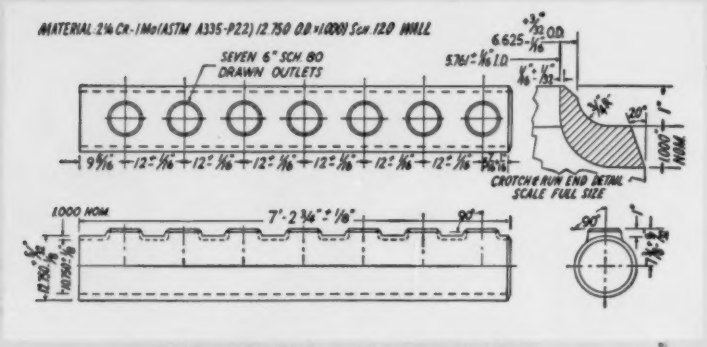
A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Denver • Los Angeles San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

APPLICATIONS

Why TUBE-TURN Manifold Welding Fittings give you safer service

In conventional pad and saddle construction, the transition to the side section of the branch is abrupt, creating stress concentration, often leading to failure. The TUBE-TURN* Manifold Welding Fitting with *integral extruded outlets,* is superior in strength. It provides a smooth transition from the pipe run to the smaller, thinner-walled outlets, and is thus better able to withstand cyclic stress from pressure or temperature changes.


MATERIAL: 2¼ Cr-1 Mo (ASTM A335-P22) 12.750 OD x 1.000 Sch 120 WALL
SEVEN 6" SCH 80 DRAWN OUTLETS
6.625 OD
5.761" I.D.
20°
1.000" MIN.
CROTCH & RUN END DETAIL SCALE FULL SIZE
1.000 NOM.
7'-2 3/4" ± 1/8"
90°

12" Manifold with Seven 6" Outlets. Schedule 80.

TUBE-TURN Manifold Welding Fitting being installed in a measuring station of a large west coast gas utility.

CODE APPROVED

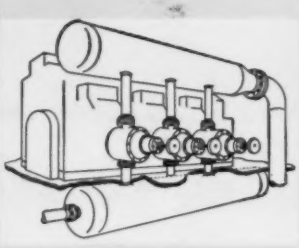
TUBE-TURN Manifold Welding Fittings are in full accordance with the latest recommendations of ASA B31.1 Subcommittee No. 8.

TUBE-TURN Manifold Welding Fittings comply with the requirements of ASA B16.9 and ASTM A234 covering the design and manufacture of butt welding fittings.

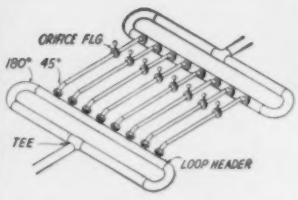
TYPICAL APPLICATIONS

TUBE-TURN Manifold Welding Fittings can be used in virtually all types of major piping systems. Tube Turns' Sales Development Department will be glad to assist you in application problems.

Pipe Still or Charge Heater



Compressor Station Suction and Discharge Headers



Meter Run Loop Header

MANIFOLD DATA

Send for bulletin covering Manifold Welding Fitting Applications. Just mail the coupon.

TUBE TURNS, Dept. A-3
224 East Broadway, Louisville 1, Kentucky

Please send bulletin on new Manifold Welding Fittings.

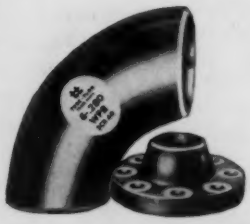
Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____



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Philadelphia	San Francisco
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Cleveland	Atlanta
Detroit	Tulsa
Chicago	Houston
Denver	Dallas

Midland, Texas

*"TUBE-TURN" and "⊞" Reg. U. S. Pat. Off.

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

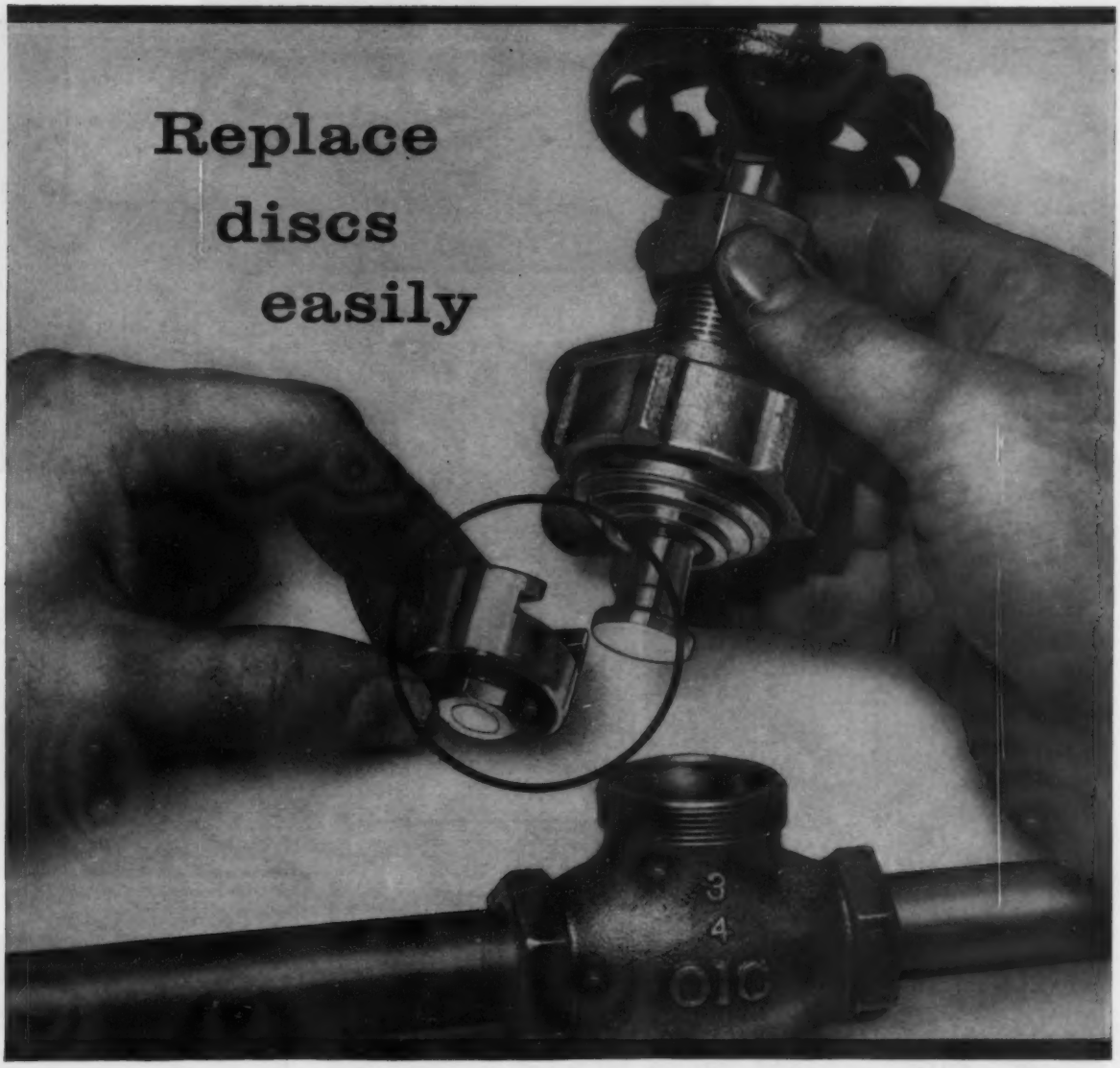


Fig. No. 520, 200 lbs. WSP, @400°F. 400 lbs. cold WOG, non-shock

It takes two minutes or less! Simply break the union joint and slip a replacement disc holder onto the button-head of the stem. Or, replace the disc only.

Additional features of this OIC line greatly reduce the need for other maintenance. For example: (1) The modern union body-bonnet joint assures a safe, tight, leakproof seal which is not affected by frequent dismantlings. (2) The special OIC *alloy-40* stem material eliminates galling and seizing. (3) Molded, graphite-asbestos, plastic packing is used which seals without hardening or cracking in service.

Reduce your valve problems by installing this OIC line wherever you need bronze globe and angle valves with composition discs. Call your OIC Distributor for more facts, or write for Form No. 1001 which describes the entire OIC 500 line with composition discs, as well as spherical and plug-type discs in globes, angles and checks.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

VALVES | **FORGED & CAST STEEL, BRONZE & IRON, LUBRICATED PLUG VALVES**

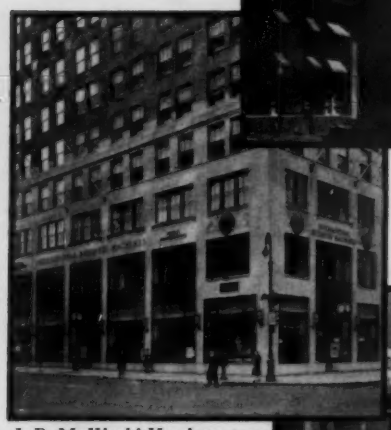
P-508

Electronic Supply Office
Great Lakes, Ill.

Fairview Hospital
Minneapolis, Minn.

M. H. Lamston
Stores
New York, N. Y.

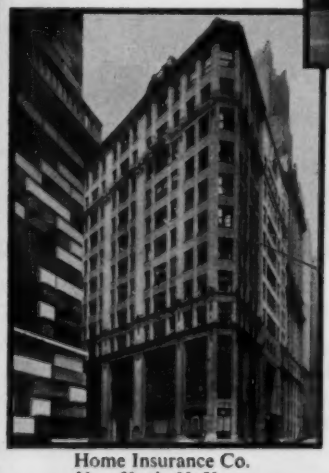
Sinclair Oil Building
Tulsa, Okla.



I. B. M. World Headquarters
New York, N. Y.

Dearborn Federal Savings and Loan
Dearborn, Mich.

Lever House
New York, N. Y.



Home Insurance Co.
New York, N. Y.

Decatur Macon County Hospital
Decatur, Ill.

General Telephone Directory Co. *Des Plaines, Ill.*

First National Bank
Little Rock, Ark.

"SOME LIKE IT HOT . . .

SOME LIKE IT COLD . . ."

Tuttle & Bailey High Pressure Units

insure indoor weather that satisfies everybody!

No two of these buildings are alike in architectural concept. Each has an individual cooling and heating problem. But all have one thing in common: in every one of these outstanding buildings, and others like them, Tuttle & Bailey High Pressure Air Distribution Units are providing maximum comfort for occupants, efficiently and economically.

No matter what the system design called for — cooling only, heating only, or a combination of both — the wide range of T & B units permitted selection of equipment to meet the *exact* requirements.

Real savings in overall building and installation costs resulted from the installation of high pressure systems. Conduit risers, and a reduction in the number of supplementary equipment rooms, added much more useable — and rentable — floor space. Conduit branches reduced floor-to-floor dimensions.

For complete information on the advantages of a high pressure air distribution system in new construction or for remodeling, get in touch with your nearest Tuttle & Bailey Representative or write for Catalog No. 109 and Bulletin No. 110.

TUTTLE & BAILEY INC

NEW BRITAIN, CONN.

FAMOUS FOR QUOTATIONS

"IDEAS ARE THE ROOTS OF CREATION"
ERNEST DIMNET

It takes ideas—good solid ideas—to improve a product. Here are two shining examples of Wolverine product improvements in action:

The first—Wolverine extruded aluminum shapes—lets you design to tighter tolerances, enhance product appearance with satin smooth finishes.

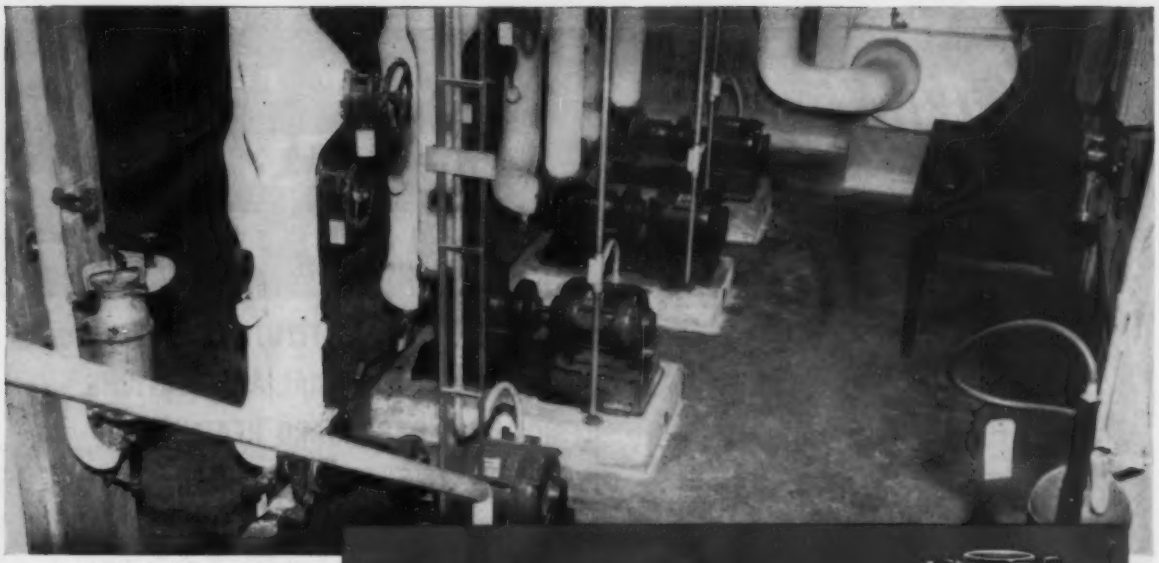
The second—Wolverine aluminum extruded or drawn tube—gives you a chance to pare weight, adds years to product life.

Both products, along with Wolverine copper and electric-welded steel tubing, are rigidly quality controlled. *Bonus idea!* Wolverine, too, is famous for quotations. Get one before you place your next order. Aluminum alloys: 1100 (2S), 3003 (3S) and 6063 (63S). Write for the Aluminum Tube Catalog.

WOLVERINE TUBE, 1461 Central Avenue, Detroit 9, Michigan.

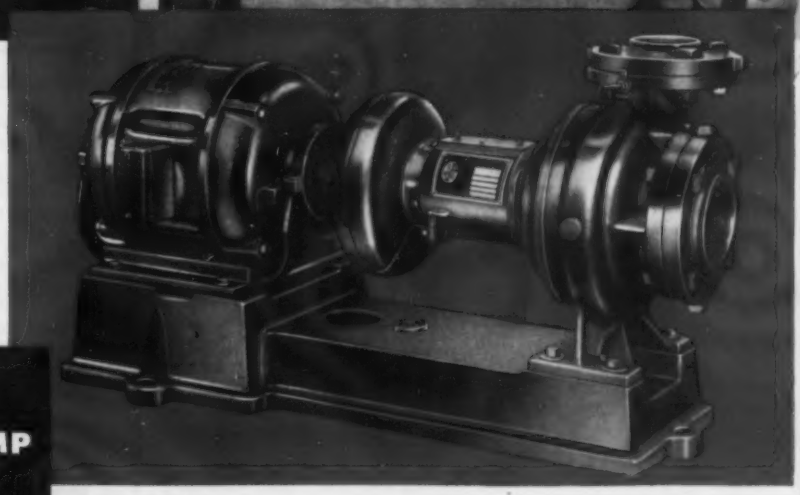
WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.
EXPORT DEPT. 13 E. 40TH ST., NEW YORK 16, N. Y.



B & G Universal Pumps in combination heating and cooling system.

for noiseless operation



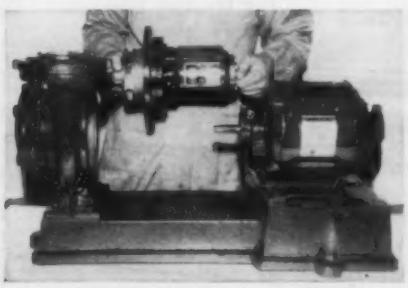
B&G
UNIVERSAL PUMP
designed specifically to operate *QUIETLY* in hot water heating systems

To perform satisfactorily in forced hot water heating systems, a centrifugal pump must have more than mere ability to meet head and capacity requirements. Unless *quiet operation* is a built-in feature, the pump may be a potential source of trouble.

B & G Universal Pumps are designed and built to meet this prime requirement of forced hot water heating systems. Noise has been engineered out...*you have to touch a B & G Universal to tell if it's running!*

This pump is available in a complete capacity range for apartments, institutions, commercial and industrial buildings. For smaller installations, the B & G Booster offers the same qualifications of noiseless, dependable operation.

Complete data is given in the B & G Catalog—send for your copy.

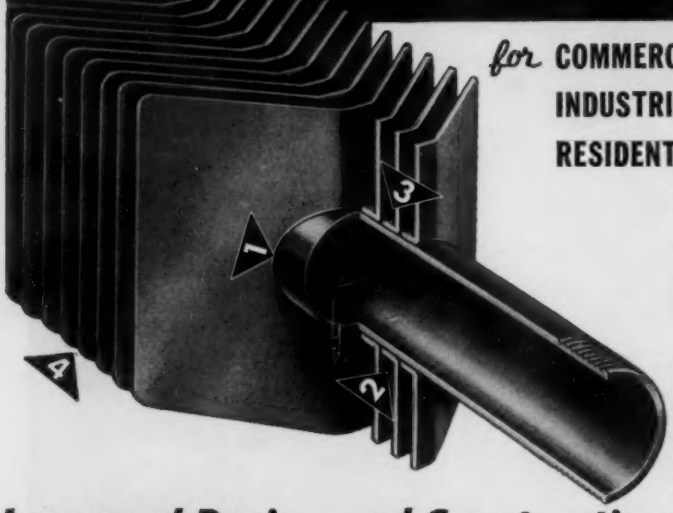


EASIER TO SERVICE

The B & G Universal Pump can be serviced without breaking pipe connections. Removal of a few bolts permits separation of bearing bracket and motor from the pump head—making all parts accessible. Precision manufacturing methods assure positive accuracy of fit and complete interchange of parts between pumps of the same size.

BELL & GOSSETT
COMPANY
Dept. DX-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, West Toronto

SLANT-FIN TELLS WHY THIS IS BETTER FINNED PIPE



for **COMMERCIAL and INSTITUTIONAL HEATING.**
INDUSTRIAL and SPECIAL APPLICATIONS.
RESIDENTIAL BASEBOARD HEATING.

Improved Design and Construction

1 **BETTER FIT OF FIN TO PIPE.** With exclusive equipment designed by Slant-Fin engineers, pipe is forced through undersize hole in fins under tons of hydraulic pressure. No weakening of pipe walls by expanding pipe or by fins cutting into pipe surface. The result is the **strongest mechanical union of pipe and fin.**

2 **PERFECT THERMAL BONDING.** On a special machine, standard pipe is rolled to uniform, absolutely round diameter. Wide flanges of fins press solidly against entire surface of pipe for **highest heat transfer efficiency.**

3 **PRECISION SPACING AND EXTRA STRENGTH.** For the flanges of the fins, Slant-Fin devoted much time to experimental engineering. Because of the uniformity of the flanges and their interlocking features, the **fins fit tightly one into another.**

4 **MORE EFFICIENT AIR CIRCULATION.** Because of the increased surface, **fewer** of the distinctive "V" shaped **slant fins** than the traditional square fins can furnish the same radiation per linear foot of pipe. Therefore, fins can be wider apart and a greater volume of air flows more freely.

5 **NO SNAPPING — NO BUCKLING OF FINS.** Because of the **patented notched flange,** the slant-fin can expand and contract without disturbing the bond to the pipe, even under high steam pressures. The result is a radiator that is trouble-free and **noiseless.**

Write today for CATALOG NO. 505, a 20-page manual with details about the most complete line of finned pipe radiators and enclosures.

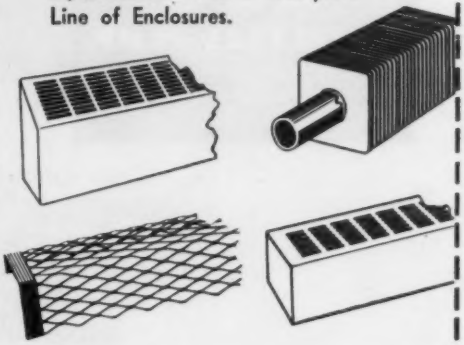
SLANT-FIN RADIATOR CORPORATION
87-65 130th Street, Richmond Hill 18, New York

MORE SURFACE IN SAME AREA

Fewer of the newer slant fins than the traditional square fins can supply the same radiation per lineal foot of pipe.

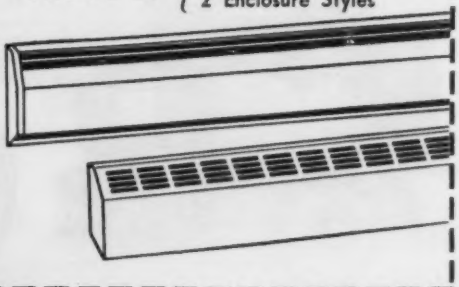
Unique "V" fin design of the SLANT-FIN Series is a symbol of the quality and the advanced engineering that also is found in the Square-Fin Series.

***SLANT-FIN* MAKES THE BETTER SQUARE-FIN** and a Complete Line of Enclosures.



RESIDENTIAL BASEBOARD HEATING
For Steam and Hot Water

CHOICE OF { 3 Heating Elements
2 Enclosure Styles



THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa)* . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa).*

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

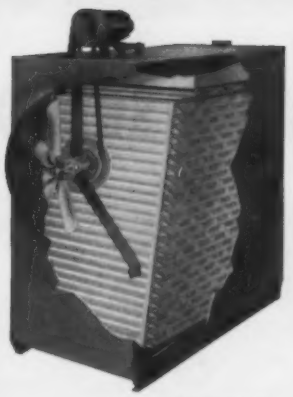
With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

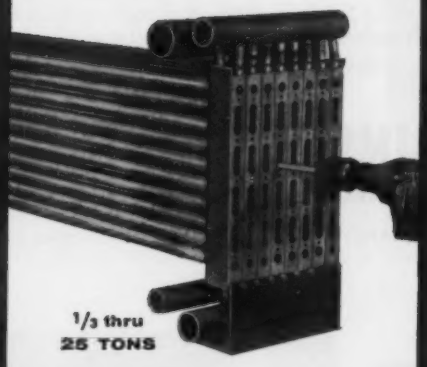
on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.



2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

At Leading Heating and Refrigeration Wholesalers EVERYWHERE

Write for Detailed Specifications

Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

JOHNSON CONTROL at NORTHLAND Insures

Expert opinion rates Detroit's remarkable Northland Center as not only the largest of all shopping centers, but as the most nearly perfect in providing *total* comfort and convenience for its patrons.

The comfort *control* problems involved here are particularly interesting. The year 'round air conditioning system involves 72 air handling units in the six buildings. For economy, a central plant supplies all steam and chilled water.

The *number* and *sizes* of the individual stores are important considerations. The 90 tenant stores range upwards in area from a few hundred to tens of thousands of square feet. Comfort requirements also differ by *types* of stores—nearly every kind of retailing operation is represented at Northland!

Occupancy levels change throughout the day. An average of 45,000 people shop here daily. Peak traffic reaches 68,000. Other variables include *outdoor temperatures, wind, exposure* and *large glass areas.*

To solve these and similar comfort control problems correctly, Northland Center depends on a comprehensive system of Johnson Automatic Temperature Control. Johnson engineers designed an up-to-the-minute control system that provides *ideal temperatures in every sales area in every store at Northland.* It insures tenant satisfaction and caters to customer comfort. And, equally important, the superior economy features of Johnson Control make it possible to accomplish all this at the *lowest possible* operating cost.

Next time you have a temperature control problem, give yourself the benefits of this kind of modern temperature control engineering skill. Whether it's a shopping center, store, office building, school, hotel, hospital or factory, a nearby Johnson engineer is ready with the best answer. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON CONTROL
TEMPERATURE ↕ AIR CONDITIONING

PLANNING • MANUFACTURING • INSTALLING • SINCE 1885

Appealing displays and assured comfort tempt customers to Hudson's Basement Store. More than 300 Johnson Thermostats at key locations in Hudson's and the 90 other stores respond to the slightest demand for more or less heating or cooling.

Conditioned air for small tenant shops is supplied by multi-zone air handling units. A single unit may handle 2, 4, 6 or 8 shops. Each shop has individual temperature control. Entrance heaters are also controlled.

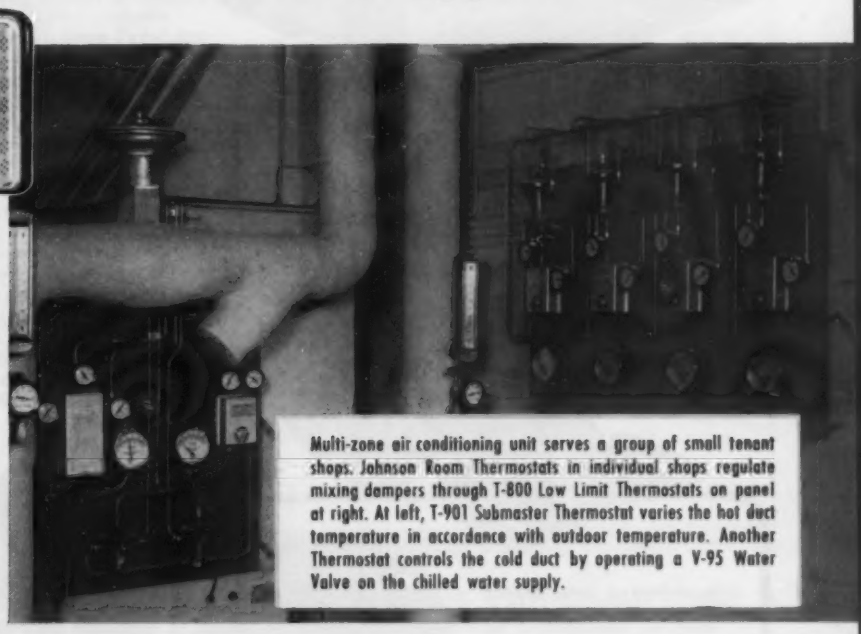
Larger tenant spaces have separate air handling units and controls. Solving the great variety of control requirements at Northland is an excellent example of the flexibility of Johnson Control.

Northland Regional Shopping Center, Detroit, Michigan. Architect: Victor Gruen Associated Architects & Engineers, Inc. Consulting mechanical engineer: H. E. Beyster & Associates, Inc. Heating contractor: The Donald Miller Co. Air conditioning contractor: Carrier Corporation.

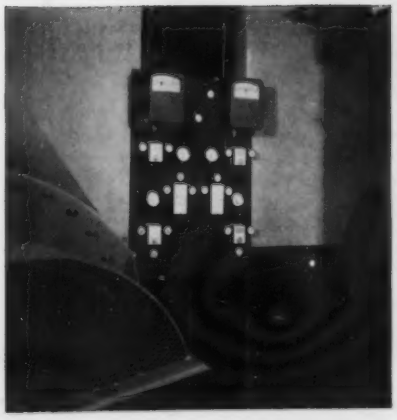
NORTHLAND HIGHLIGHTS. World's largest shopping center. Includes The J. L. Hudson Co. Department Store (over 470,000 sq. ft.) and 90 shops in 5 other tenant buildings (over 525,000 sq. ft.). Hudson store is the largest built in over 25 years. Center is completely air conditioned, with 3,600 ton central refrigeration plant and 900 hp central steam plant. Store frontage totals 1¼ miles. In Hudson's alone, there are nearly 10 miles of heating, ventilating and air conditioning ducts.

Ideal Temperatures for 45,000 Shoppers a Day!

READ HOW THIS JOHNSON-ENGINEERED CONTROL SYSTEM PROVIDES MADE-TO-ORDER WEATHER FOR EACH OF 90 STORES . . . HELPS LARGEST SHOPPING CENTER GET THE ECONOMIES OF CENTRAL STEAM AND REFRIGERATION PLANTS



Multi-zone air conditioning unit serves a group of small tenant shops. Johnson Room Thermostats in individual shops regulate mixing dampers through T-800 Low Limit Thermostats on panel at right. At left, T-901 Submaster Thermostat varies the hot duct temperature in accordance with outdoor temperature. Another Thermostat controls the cold duct by operating a V-95 Water Valve on the chilled water supply.



Panel mounted controls for twin air handling units in the Hudson store. On each unit a Johnson Submaster Thermostat controls a Steam Valve on the reheat coil to regulate final discharge temperature of conditioned air. Correct discharge temperature is determined by strategically located Room Thermostats that average sales area temperatures and pilot a Pressure Regulator which resets the Submaster Thermostat.

On adjoining units, powerful Johnson Damper Operators regulate Dampers on minimum and maximum outdoor air and return air as determined by Dew-point Thermostats. Another Thermostat on the unit at right acts as a Safety Thermostat on the Steam Valve. Hudson store is served by 18 large built-up units, 14 of which are installed in pairs as shown.

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

WAGNER offers something NEW in small motors

More compact capacitor-start and split-phase motors—¼ hp and below—*that help the design engineer in a tight spot!*

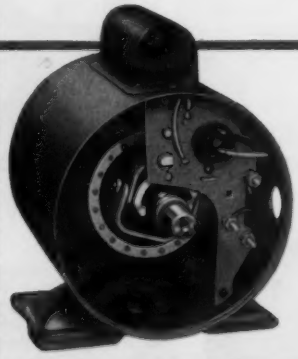
For design engineers who've been looking for more efficient fractional horsepower motors with less bulk... here's good news!

Now, you can get smaller, more compact Wagner capacitor-start and split-phase fractional horsepower motors with many new added features such as *a new endplate design, a new lubrication system that permits all-angle mounting and a new terminal board and switch location.*

Yet these re-designed motors retain all of the proven features that have made Wagner motors famous for quality for more than 60 years. Bulletin MU-200 gives complete information—write today for your copy.

When you specify Wagner Motors—you get the advantage of a liberal warranty... of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 850 Authorized Service Stations. You can choose from a wide variety of types and sizes—singlephase or polyphase—from 1/25 to 400 horsepower.

Inside view of sleeve bearing endplate with seal removed to show felt packing used for lubrication. In addition to the continuous strip, a spring-loaded piece of felt makes constant-pressure contact with the shaft through an opening in the top of the bearing.



View of the type RK motor with endplate removed showing terminal board on which thermal protector and quick-break switch are mounted. Note thickness of steel frame which has been machined for accurate endplate fit. Rigid base is welded directly to the frame.

Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation EST. WE 1891

M53-12

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

For Top Economy - SKIDMORE HAS NO EQUAL!

"HS"

CONDENSATE PUMP

Furnished in single or duplex units.

Cost less to install! Cost less to operate!

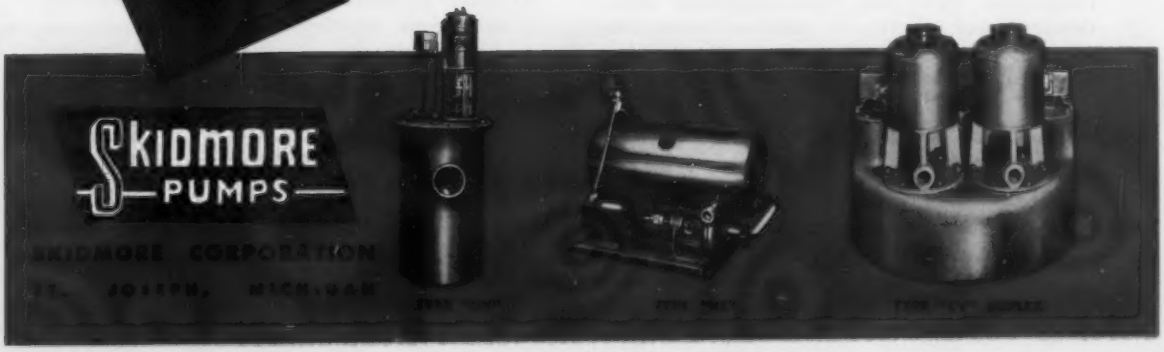
Here's a condensate pump that spells savings for you all along the line . . . from the very start — its installation costs less . . . and year after year of efficient service its operating cost, is still less, than comparable pumps.

The performance and dependability of the popular Skidmore "HS" Pump is well reflected in the hundreds of installations throughout the country. The type HS Pump is designed to operate at a wide range of pressures — including operation at high temperature encountered in condensation pump service. Pump consists of horizontal unit with motor, receiver and float switch, mounted on flat base. Pump can be disassembled without disturbing piping connections.

SEND FOR YOUR COPY

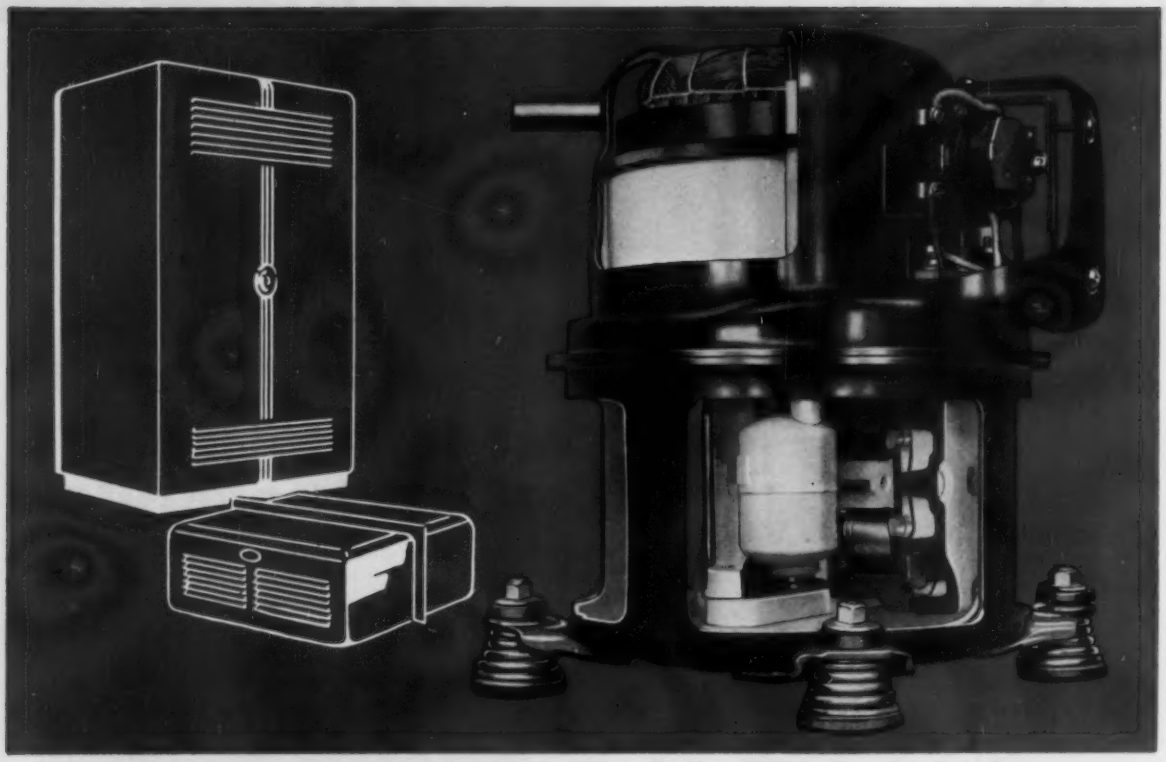
Complete engineering data and capacity tables are yours for the asking. Be sure and send for Bulletin No. 14-A.

SKIDMORE IS SYNONYMOUS WITH QUALITY AND ENGINEERING LEADERSHIP SINCE 1921



WHISPER-QUIET **POWER**

for package Air Conditioning



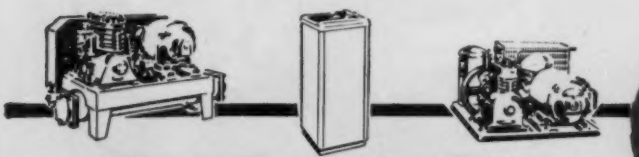
COPELAWELD *HERMETIC*

It takes real engineering (and knowledge of your customers' needs) to produce a welded motor-compressor that combines positive performance, vibration-free smoothness, and maximum operating economy.

Copeland gives you these design advantages and more . . . plus precision manufacture using finest components. Heavy-duty, high-power-factor motor delivers power aplenty with minimum current consumption. Freon-12 and Freon-22 models available. Use of Freon-12 can give you as much as 75°F. lower temperatures in windings, crankcase, oil and discharge side. Unusually high capacities make Copelaweld motor-compressors adaptable to virtually every type of duty.

Power all your air conditioning and refrigeration equipment with Copeland motor-compressors. It's *the* quality equipment that enhances your reputation by its long-run, trouble-free service.

Get full details . . . write today for complete information on the profit-making Copeland line.



REFRIGERATION UNITS (OPEN TYPE AND COPELAMETIC) WATER COOLERS

Copeland

DEPENDABLE REFRIGERATION

COPELAND REFRIGERATION CORPORATION · SIDNEY, OHIO

ROTARY'S new headquarters

On its 50th anniversary Rotary International welcomes its members from 8600 clubs in 90 different countries to visit its new headquarters in Evanston, Illinois.

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MAHER and McGREW
Evanston, Ill.

Consulting Engineers
NEILER, RICH & BLADEN
Chicago

Air Conditioning Contractor
C. W. JOHNSON, INC.

Plumbing Contractor
O'CALLAGHAN BROS.

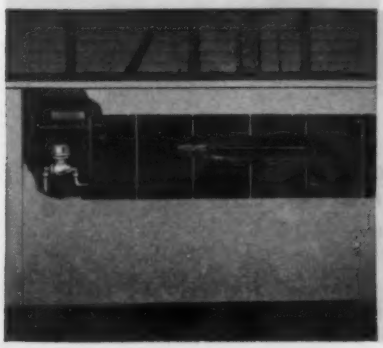
POWERS Individual Room Air Conditioning Control

. . . helps maintain perfect indoor climate

Publishing The ROTARIAN with a monthly circulation over 360,000 and handling over a million and a half pieces of incoming and outgoing mail annually . . . are only a few of the many activities carried on in this handsome new building.

Individual Room Control for each office and zone within the general office area is obtained with a Powers pneumatic thermostat and valve. Only pneumatic control provides the quiet, accurate regulation insured by Powers time-proven, dependable equipment. Maintenance too, is easier and less expensive.

Powers air conditioning control began almost 50 years ago in the Congress Hotel Gold Room in Chicago. Experience gained there and in thousands of other prominent buildings is now available to you.



Powers Packless Control Valve

THE POWERS REGULATOR CO.

SKOKIE, ILLINOIS

Offices in chief cities in U.S.A., Canada and Mexico

Established 1891

Automatic Temperature and Humidity Control

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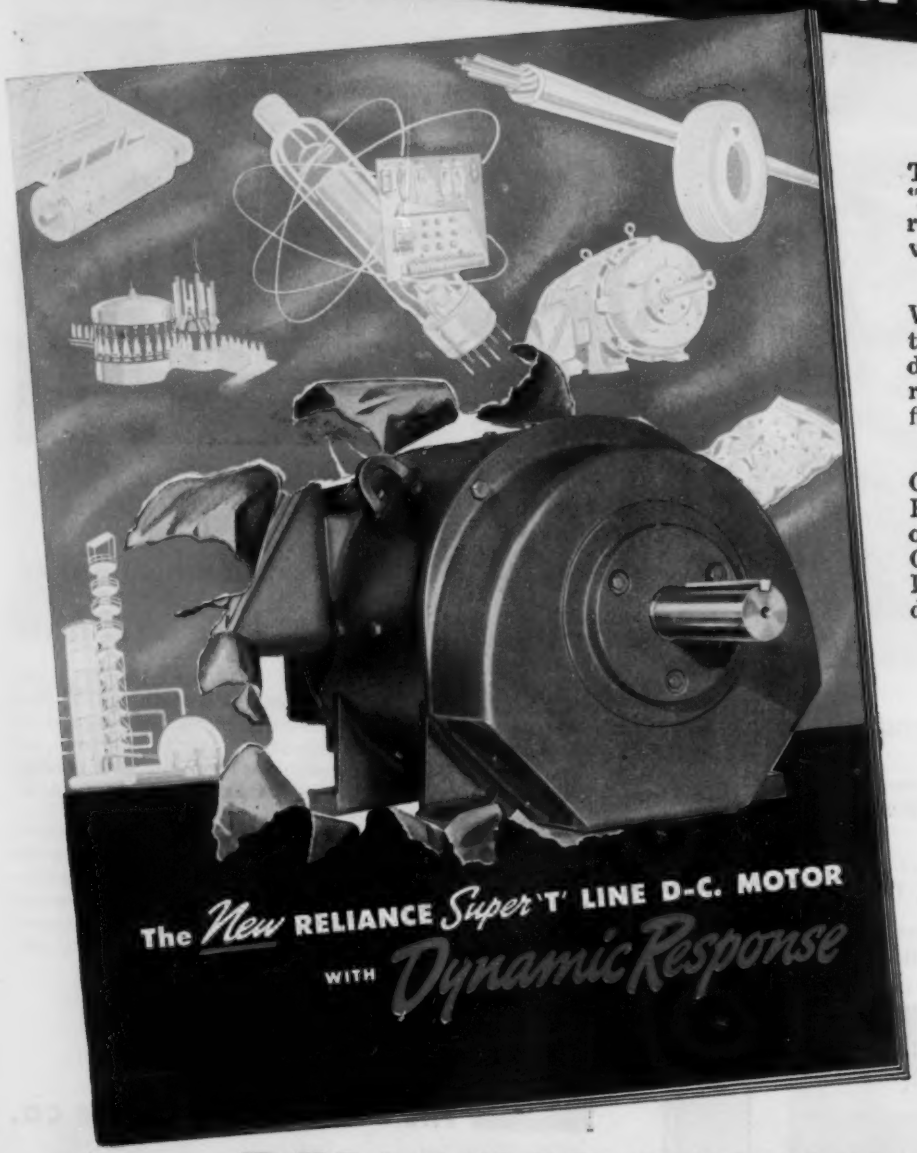
HAVE YOU HEARD ABOUT THE *Revolutionary New Motor* WITH DYNAMIC RESPONSE ?



The *New* Reliance Super 'T' Motor is the most revolutionary motor development in 40 years!

Whatever your application this new motor will do it better, faster—and require less machine or floor space.

Contact the nearest Reliance Sales Office—or write for Bulletin C-2002 which tells what Dynamic Response will do for *you!* C-1488

RELIANCE V★S DRIVE

RELIANCE ELECTRIC AND ENGINEERING CO.

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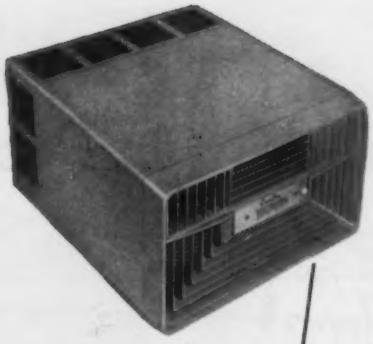
Builders of the Tools of Automation

RELIANCE Super T LINE



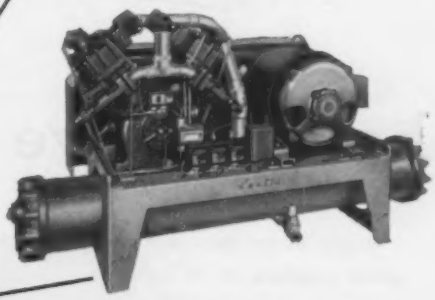
Window Air Conditioners

More jobs... More profit!

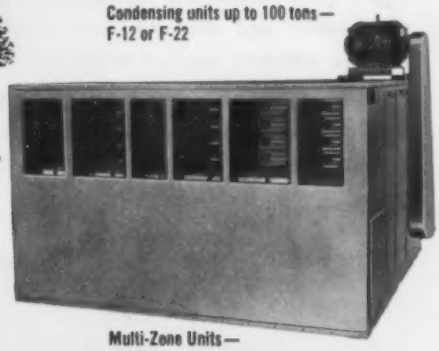
WITH THIS

complete Curtis LINE

Packaged Air Conditioning units—2 to 20 tons

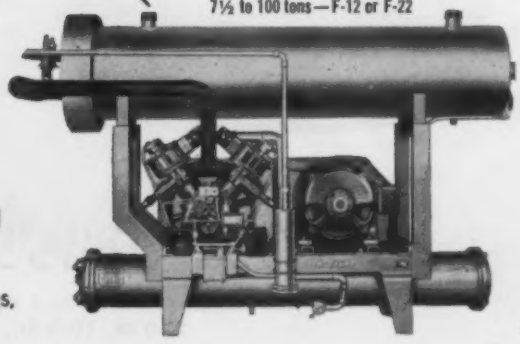


Condensing units up to 100 tons—F-12 or F-22



Multi-Zone Units—serving 2 to 8 zones

Packaged Liquid Chillers—7½ to 100 tons—F-12 or F-22



You'll sell more jobs, and make more profit, with this well-rounded Curtis line. Curtis equipment sells readily because it is backed by one of the oldest and most respected names in the business. Curtis products are presold for you by hard-hitting national advertising in *Saturday Evening Post, Time and Newsweek*, plus many national business and trade magazines.

WRITE TODAY for information on how you can obtain a Curtis direct factory franchise.

Curtis REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
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Other Curtis Products: INDUSTRIAL AND AUTOMOTIVE AIR COMPRESSORS, AUTO LIFTS, CAR WASHERS, AIR HOISTS

829

Air Conditioning's #1 Problem...

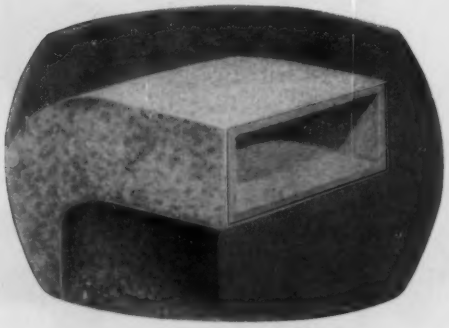
how to move air without "FAN-FARE"

Recent studies show that noise control is one of the prime problems of air conditioning today. Time and again, homeowners and businessmen complain that "fan chatter" and other objectionable noises seriously interfere with their rest and work.

The best possible way to keep your comfort-cooling customers from getting hot under the collar about noise is to install a few feet of ULTRALITE* Duct Liner in the plenum and short supply and return ducts. It's easy . . . it's inexpensive . . . it's effective — yet this simple precaution can make all the difference between a satisfactory and an unacceptable air conditioning job.

That's why it is good practice today for architects and engineers to specify ULTRALITE glass fiber duct liner on every job. That's why contractors who want nothing but satisfied customers line ducts even on jobs where duct liner is not specified.

*Reg. U. S. Pat. Off.



ULTRALITE is a flexible, semi-rigid glass fiber insulation designed specifically as an acoustical duct liner, with excellent sound-absorbing properties. Because of its unique long textile-type glass fiber composition, ULTRALITE is the strongest, most resilient glass fiber insulation. That's why it will not break, chip, delaminate or flake off in the air stream. ULTRALITE is available coated one side to minimize air friction loss. Local stocks in 57 cities are maintained to give you delivery when and where you need it. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Railroad gaskets and supplies

220 W. 10th St., Kansas City, Missouri

New Carrier

Evaporative Condenser

jumps capacity range

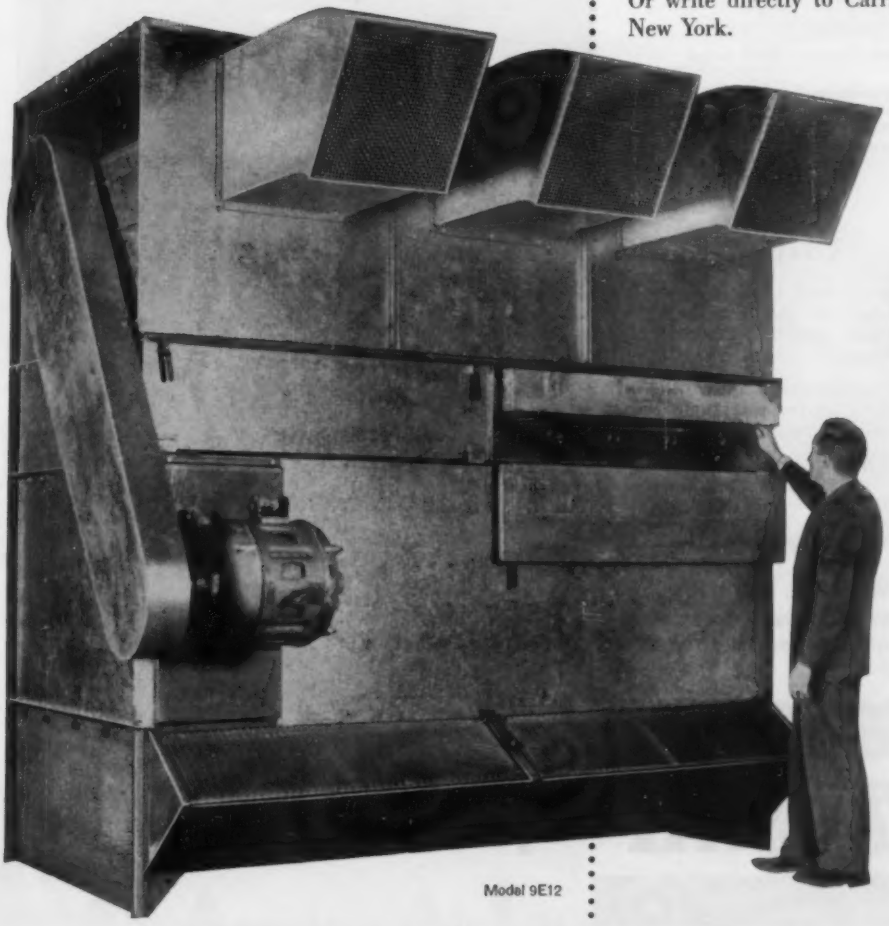
to 108 tons!

- Nominal refrigeration capacity of 108 tons (10-row coil) and 90 tons (8-row coil).
- Sectionalized construction for flexibility in application, ease in installation.
- Occupies a minimum of space (less than 80 square feet).

This rugged, new evaporative condenser brings water-saving economy to your biggest air conditioning jobs. The Carrier line of evaporative condensers now available in sizes from 14 to 108 tons of refrigeration capacity.

Like Carrier's other 9E condensers, the new large-capacity unit is built of heavy-gauge galvanized steel to minimize corrosion. It has access doors on both sides for ease in servicing the sprays and removing eliminators; prime surface, non-clog coils; quiet, high-efficiency fans. Water-treatment unit and capacity-boosting sub-cooler are optional.

Is there more you'd like to know about the new Carrier Evaporative Condenser? Please call your local Carrier dealer, distributor or branch office. They're listed in the Classified Telephone Directory. Or write directly to Carrier Corporation, Syracuse, New York.



Model 9E12

Carrier

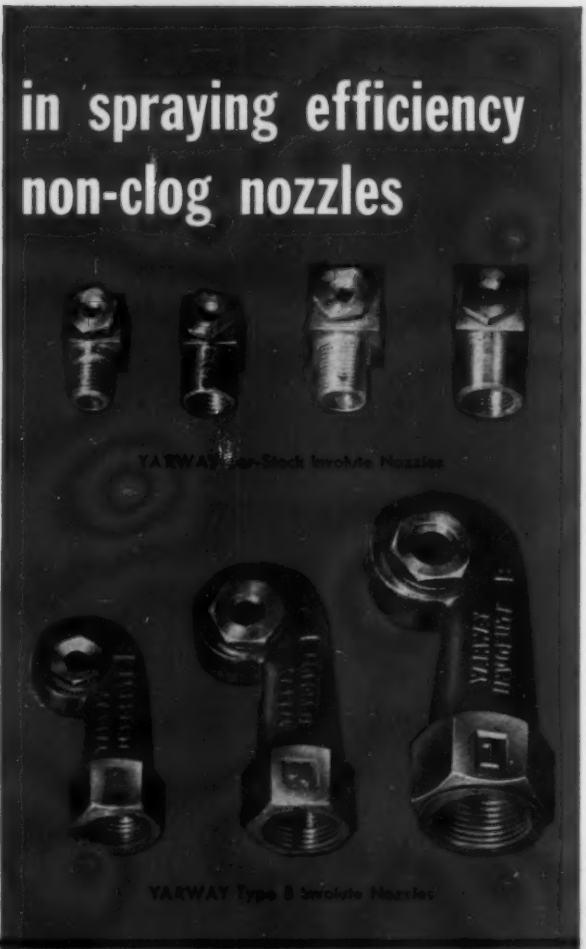
air conditioning

refrigeration

industrial heating

reach a new peak with YARWAY

in spraying efficiency non-clog nozzles



YARWAY Bar-Stock Involute Nozzles

YARWAY Type B Involute Nozzles

cone spray

Most popular design for cooling, recooling, washing, rinsing, air conditioning, drying and other spraying operations in industrial and processing work and in power plants.

Non-clog involute design has no internal parts (vanes or deflecting plates) on which foreign particles can collect. Special contour of nozzle body guides flow with minimum loss of energy towards discharge opening, where liquid attains maximum velocity and leaves nozzle in a fine hollow-cone spray.

Available in three types:

Bar-stock bronze (shown) for fine spray
Sizes ¼" and ⅜", male or female connection
Capacities up to 3 gpm; pressures 20 to 50 psi

Cast bronze Type B (shown) for air conditioning and small recooling systems
Five sizes, ½" to 1½"
Capacities up to 40 gpm; pressures 7 to 25 psi

Cast bronze Type C (not shown) for spray pond service
Sizes 2" and 2½"
Capacities up to 110 gpm; pressures 7 to 15 psi

Write for YARWAY Spray Nozzle Book N-617; it gives capacities, dimensions and application information.

fan spray

Preferred for many washing and cooling operations. Non-clog design, delivers flat fan-shaped sheet of spray with slicing action particularly desirable for surface washing.

Thin sheet of spray is discharged forward 30° from the vertical, spreading in fan shape up to 140°, depending on operating pressure.

Made of bronze, steel or other bar-stock metals, male thread, six sizes ⅛" to 1", capacities up to 7 gpm, pressures up to 50 psi.

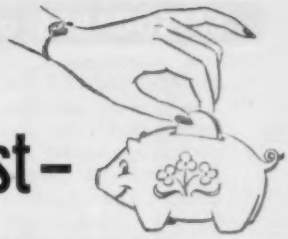
Write for YARWAY Spray Nozzle Book N-617.

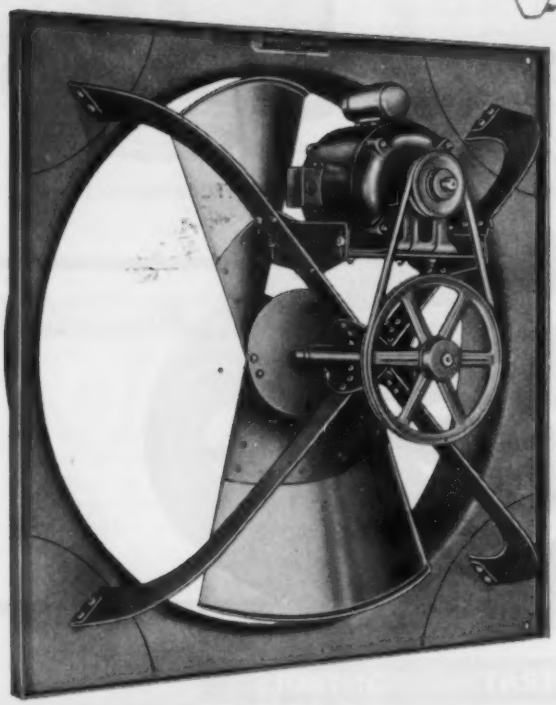
YARWAY Fan-Spray Nozzles

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY® **spray nozzles**

A lot of comfort
At a little cost–



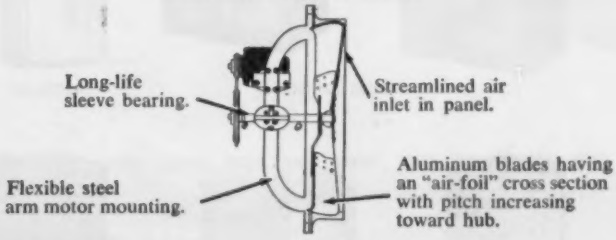


. . . HERMAN NELSON propeller fans!

A complete stock of Herman Nelson Propeller Fans is as near as your local Herman Nelson Distributor

Herman Nelson Propeller Fans are your gilt-edge investment in customer satisfaction! From the extensive Herman Nelson line, you'll find sizes, models, capacities to cover every need, from small stores and shops to large industrial plants. Right now, your Herman Nelson distributor is ready to give you experienced help plus quick service! Call on him!

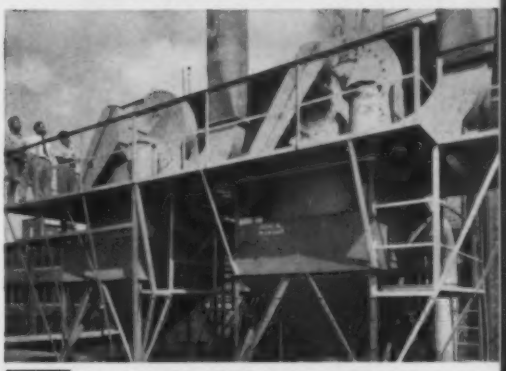
MADE BETTER TO LAST LONGER


Long-life sleeve bearing.
Streamlined air inlet in panel.
Flexible steel arm motor mounting.
Aluminum blades having an "air-foil" cross section with pitch increasing toward hub.

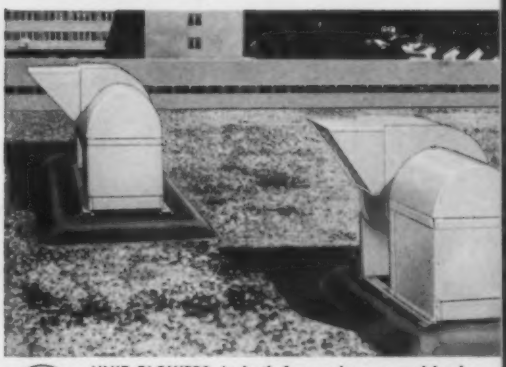
AAF herman nelson

American Air Filter
COMPANY, INC.
General Offices, Louisville, Ky.

Better Air is Our Business!



AAF **TWIN ROTO-CLONES effectively control dust and fumes given off by leather buffing in this Milwaukee tannery.**



herman nelson **UNIT BLOWERS, in both forward curve and backward curve wheel types, efficiently solve all ventilating and exhaust problems.**

herman nelson **PORTABLE HEATERS supply extra "heat on wheels" at this cold loading dock. There is a size and model for every job, capacities 75,000 to 450,000 BTU.**

Write for free literature!

AMERICAN AIR FILTER COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
Please send me complete information on the following equipment:

- ☐ Propeller Fans
- ☐ Unit Blowers
- ☐ Unit Heaters
- ☐ Electro-Cell Air Filters
- ☐ Dust Collectors
- ☐ Portable Heaters
- ☐ Steam Specialties
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ONE SOURCE with UNDIVIDED RESPONSIBILITY

a complete line of controls
and valves
for commercial and industrial
burners . . . automatically,
semiautomatically, or
manually ignited

SAFEGUARDS and PRIMARY CONTROLS

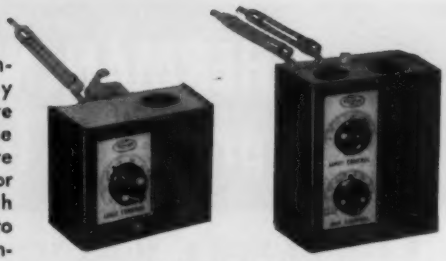
The FP-2 and FJ-2 systems provide complete flame-failure protection and programming for automatically ignited burners. Shut off fuel in 2 to 4 seconds after flame failure. Limit trial for ignition. Purge combustion chamber before and after firing.

System FP-2 for industrial burners

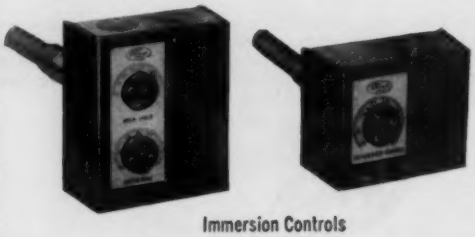
fireye®

OPERATING CONTROLS

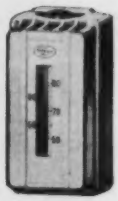
Fireye automatic controls, operated by changes in temperature or pressure, are of the highest quality. They are available individually or in combination with other Fireye controls to make a complete control system.



Air Temperature Controls



Immersion Controls



Thermostat

Pressure Controls

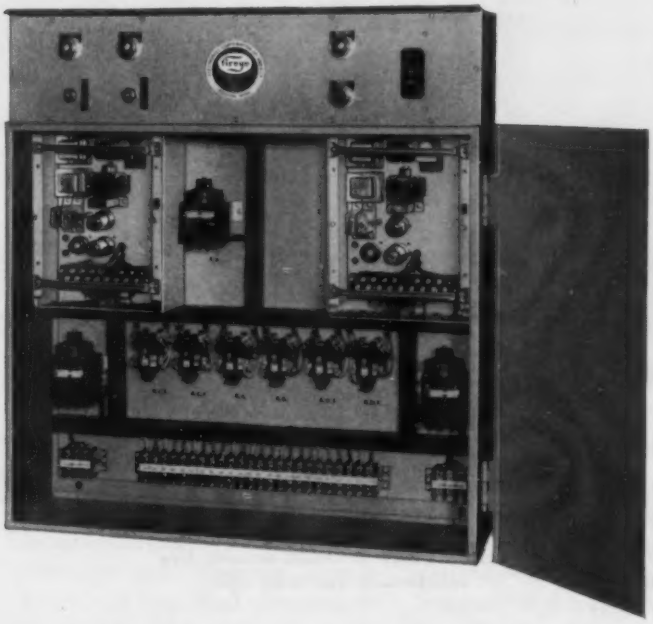
System FJ-2 for commercial burners

System FP-3 for flame-failure indication and alarm

System FP-4 for semiautomatically and manually ignited burners

NEW SAFETY INTERLOCK SYSTEM

The first fully integrated combustion safeguard system for multiple burner boilers . . . insures safe light-off and firing. Includes all external valves, switches and alarms in addition to pre-wired cabinet assembly.



SMOKE INDICATORS

Provides low-cost, easy-to-install smoke indication with assured accurate readings. Meets *all* smoke ordinances.

System FE-3

VALVES

Leakproof closing action of these safety shutoff valves makes them ideal for automatically shutting off fuel flow to a burner in event of flame failure, fan or pump failure, power failure, etc.

Manual Reset Valves

Solenoid Fuel Valves

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COMBUSTION CONTROL DIVISION ELECTRONICS CORPORATION OF AMERICA

Please send literature on the following Fireye Controls:

- ☐ Operating Controls
- ☐ Valves
- ☐ New Safety Interlock
- ☐ Smoke Indicators
- ☐ Primary Controls and Safeguards

Dept. C13-6, 718 Beacon Street, Boston, Mass.

NAME .....

COMPANY .....

ADDRESS .....

"Buffalo" TYPE "EWC" EVAPORATIVE WATER COOLERS WILL GIVE YOU MAXIMUM HEAT EXCHANGE ON A MINIMUM OF MAKEUP WATER

Liquid to be cooled passes thru finned coils in these compact, efficient units. Cooling is caused by evaporation of fine spray on the coils, under draft. Make-up water requirements are very small. Here is the practical answer to water consumption in cooling liquids — compressor jacket water — lubricating oils — quench oils — Diesel, natural gas and other engine jacket water — all in a closed system that keeps impurities out. "Q" Factor* features in "EWC" Units include quality "Buffalo" Fans and Pumps, and heavy-duty 3-section cabinet for easy installation and maintenance. Write today for Bulletin 3666A!

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY
171 MORTIMER STREET BUFFALO, N.Y.
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
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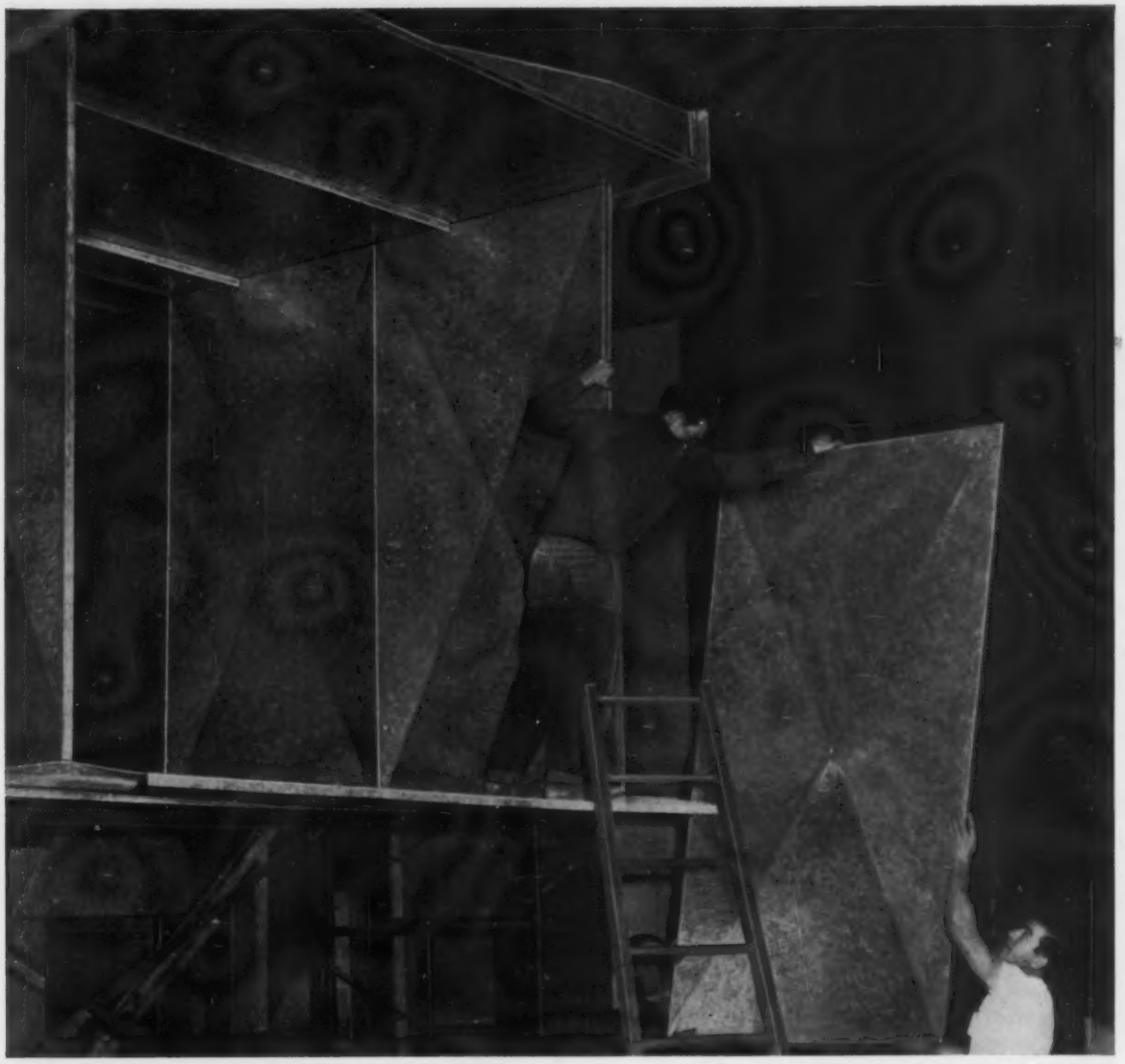
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



Spokane Coliseum is air-conditioned through Bethcon ducts

Opened last autumn, the $2½ million Spokane Coliseum is the largest civic auditorium in the Northwest. Its huge interior will serve 3000 banqueters, or seat 8500 boxing fans . . . in air-conditioned comfort the whole year around.

Carrying conditioned air from plant to public required some 60 tons of ductwork, fabricated of Bethcon galvanized sheet steel by Fox-Smith Sheet Metal Works of Spokane. Bethcon sheets are galvanized in Bethlehem's continuous hot-dip line, and they have a uniform, tight zinc coating that is a delight to the eye. And Bethcon spangles tend to hold their lustre longer. Many sheet-metal men say that Bethcon is superior to any they have ever used in severe drawing or forming operations.

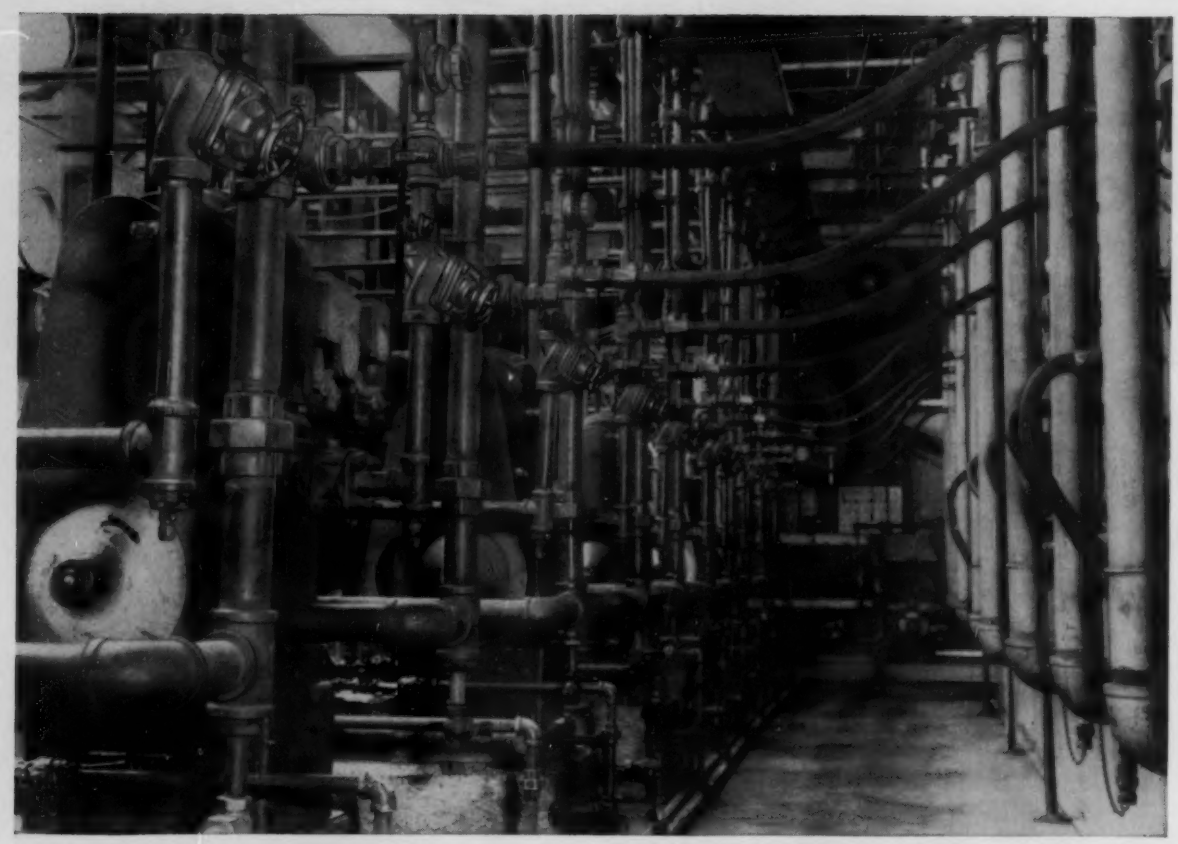
Try Bethcon on the next tough job that comes into your shop. It is made from high-quality cold-rolled open-hearth steel, both plain and copper-bearing. You can get it in gages 18 and lighter, in sheets up to 48 in. wide. For further details, just call our nearest sales office, or drop us a line direct.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Holding high vacuum with low upkeep is routine for these CRANE VALVES

At the Crosley & Bendix Home Appliance Divs., Avco Mfg. Corp. refrigerator plant at Richmond, Ind., a line vacuum within a few microns of absolute is applied to a dehydration process. But holding this vacuum wasn't always a routine operation.

There was a time when frequent valve failures caused production losses and costly maintenance—stopped only when Crane Packless Diaphragm Valves were installed.

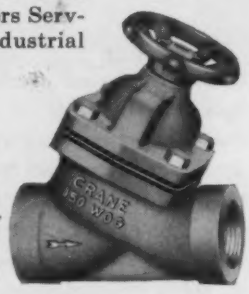
Of the valves formerly used, a multiple metal diaphragm type lasted about 3 months. Crowning of diaphragms caused restriction or closure and made the valves inoperable. Damaged diaphragms meant complete valve replacements.

In other valves, in-leakage at the diaphragm-to-stem connection made them unsatisfactory.

Now in service more than a year, none of the Crane Kel-F Diaphragm Valves has needed any maintenance. Crane simplified construction, giving a longer-life diaphragm... tighter bonnet seal and seating . . . and easier operation . . . is the reason.

The diaphragm in Crane design has longer life because it seals the bonnet only—is not subject to the cutting and crushing encountered when also used for seating. The separate, positive seating disc controls fluid even should diaphragm fail. Wide selection of body materials and trims. Ask your Crane Representative for Circular AD-1942.

Crane Co., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas.



CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

the UNARCO ROYAL-AIRE ...your new "silent salesman"

Efficient in operation and smart in appearance, the all-new UNARCO *ROYAL-AIRE* may be this year's most profitable investment for you.

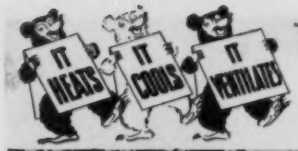
The *ROYAL-AIRE* is styled to fit into most any background. Four-way directional louvers, generous-sized components, and a large vertical cooling coil provide maximum dehumidification and cooling. *The exclusive* UNARCO *pump-down control system guarantees instant cooling coil response* and reduces system-operating pressures.

The *ROYAL-AIRE* is available in 5 full-rated models, capable of conditioning exactly to *your* needs. It is especially adaptable to many different and normally difficult kinds of installations. Being "demountable" into three sections, it is extremely easy to handle and install.

Both to the contractor interested in building a reputation for quality, and to the buyer looking for efficient, dependable air conditioning... there is no better buy than the UNARCO *ROYAL-AIRE*.

UNION ASBESTOS & RUBBER COMPANY
332 S. Michigan Avenue • Chicago 4, Illinois

the UNARCO ROYAL-AIRE ...a quiet, efficient AIR CONDITIONER



Year 'round comfort for institutional or commercial installations . . .

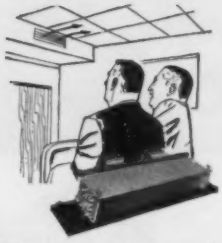
without costly duct systems!

Modine AIRditioners are the modern, economical way to air-condition old or new buildings

Modine AIRditioners eliminate expensive duct systems and structural alterations. Cold water from a central chiller is piped to each unit for summer cooling. Heating water is supplied by a central boiler. The same piping — water supply and drain — serves for both cooling and heating. Yet, AIRditioners are individually controllable by room occupants.

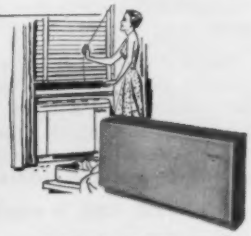
Choice of four distinct types. Contact the Modine representative listed in your classified phone book or write for Bulletin 754-D — MODINE MFG. CO., 1509 DeKoven Ave., Racine, Wisconsin.

CEILING MODELS — deluxe units for exposed overhead installation. Save floor and wall space.



OVERHEAD MODELS—available with or without plenum and filters for use in furred overhead space.

CONCEALED MODELS — (front panel cutaway) Designed for easy, in-the-wall installation.



CONSOLE MODELS — for free-standing installation. Can also be recessed so only 6 inches of cabinet shows.

Modine Airditioners*

*Trademark

A-1262

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A New Approach to Perfection

LIMA

New NEMA Frame Sizes

No longer is it necessary for the designer to compromise motor power or performance to meet size and weight limitations!

Now, Lima has in production all ratings in new NEMA frame sizes 182, 184, 213 and 215—with the 254U through 326 frames following on an accelerated schedule.

If your application requires greater efficiency in a smaller size with less weight, better protection and longer service-free life . . . then these new Lima Motors have been designed for you! Get detailed information from your Lima Representative now. If he is not already calling on you, his name and address will be found in the following Trade Directories: *Thomas' Register, Mac Rae's Blue Book,* or *Conover-Mast Purchasing Directory.*

Of course, the former NEMA frame sizes 66 to 505 (⅓ to 150 H.P.), incorporating the latest advances in motor design, will remain in production.

THE LIMA ELECTRIC MOTOR COMPANY, 4979 Findlay Road Lima, Ohio

Representation throughout the U. S., Canada and abroad

FIRST . . . FOR MOTORS . . . DRIVES . . . SPEED REDUCERS

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In 465 B.C., Xerxes the Great, King of Persia, got help from fan bearers to solve his air conditioning problem. Today Airtemp can help you solve the specific air conditioning needs of your clients.

AIRTEMP gives you specialized service

Let Airtemp give you these special helps in planning your commercial and industrial air conditioning

The equipment you need
To meet your clients' needs, Airtemp offers a complete range of modern air conditioning systems. Both conventional and specially-engineered types, for a room or a building.

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You get help from engineering specialists—pioneers in commercial and industrial air conditioning—through Airtemp Construction Corporation, subsidiary of Chrysler Corporation.

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Your clients have confidence in Chrysler's leadership. And dependable Airtemp service has gained full public acceptance.

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Your guarantee of continuing local service is the nationwide network of trained Airtemp personnel and facilities.

Lower costs per job
Operating costs are lower, due to the highly efficient Airtemp operation and design.

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Grace-New Haven Community Hospital, New Haven, Conn. Architect: Douglas Orr; Engineers: Hubbard, Lawless and Blakely.

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AIR CONDITIONING • HEATING FOR HOMES, BUSINESS AND INDUSTRY

NO TORCH!

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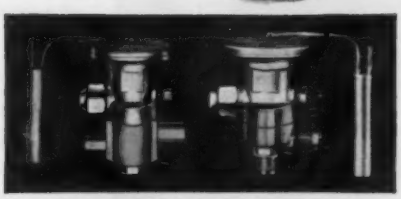
ALCO design saves you money and time

you service

"T" SERIES ALCO THERMO VALVES

without breaking connections



SOLDER OR SAE FLARE

For all temperature ranges—all operating conditions.
.5 ton—50 tons "F12"
.5 ton—80 tons "F22"

Loosen cap screws, raise power element, lift out the cage... that's all! Alco come-apart construction gives instant access to all working parts... for cleaning, repair or capacity change.

2½-inch headroom is sufficient space for installation and servicing!

Save money—save servicetime—install ALCO "T" Series Thermo Valves!

write for bulletin 171-53 today

SEE YOUR ALCO WHOLESALER

ENGINEERED
for service
for life

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

ALCO

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

6200D

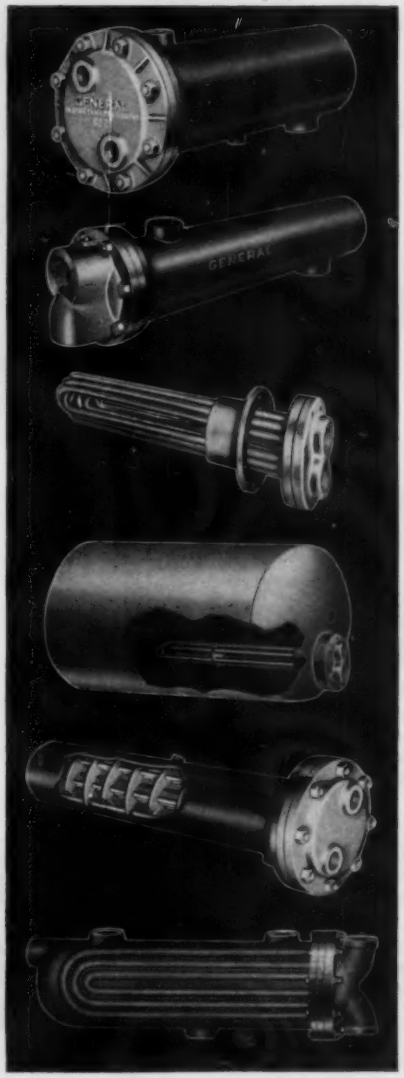
This specialized line

Squeezes more B.T.U.'s out of Fluid-heating Dollars

Whether the heat source for your next installation is hot water, exhaust steam, or live steam, you'll find a **GENERAL** Industrial Fluid Heater specifically designed to get the most heat out of it.

Every **GENERAL** heater is backed by 25 years experience in the manufacture of industrial fluid-heating equipment. It's the end-product of constant modification and improvement . . . "tops" for its particular application.

No matter what job you're planning — new construction, expansion, modernization — this up-to-date line is your best bet . . . for better performance, longer service, lower cost. Write for Catalog 60. General Fittings Company, Box 151E, East Greenwich, Rhode Island.



INSTANTANEOUS WATER HEATERS No tank required. 23 sizes; capacities to 300 g.p.m.; uses live or exhaust steam.

CONVERTERS 74 sizes for economical heat transfer. Flow capacities up to 900 g.p.m.

TANK HEATING UNITS 20 sizes for all requirements.

STORAGE TANKS 10 sizes; capacities to 315 gals.

FUEL OIL HEATERS 17 sizes; capacities to 375 g.p.h. at 2 lbs. pressure.

INDIRECT HEATERS 15 sizes for use with large-size storage tanks.

GF GENERAL FITTINGS COMPANY

TANKLESS AND INDIRECT WATER HEATERS AND HEATING SPECIALTIES

A Small But Important Detail On The G-E "All-In-One" Sealed Cooling System...

THE "CIRCUIT-BREAKER" OF Pressured Systems

The BS&B *Sealed Type* SAFETY HEAD!

General Electric's 1954 line of packaged air conditioners features an "all-in-one" hermetically sealed refrigeration cycle. To meet specific code requirements, this cycle incorporates a tiny safety guardian against loss of refrigerant and damage to the system... the BS&B SEALED TYPE SAFETY HEAD.

This low-priced "throw-away" SAFETY HEAD unit functions much like a fuse in your electrical system, and provides that important *extra margin of safety* at a very nominal cost. Factory assembled and sealed, it consists of a brass fitting containing a fine silver rupture disc which is designed to rupture at a safe predetermined pressure. The entire unit is no larger than a "man's thumb," yet it provides instantaneous and positive pressure relief... and is guaranteed leak-proof.

Chosen by General Electric and other nationally known manufacturers of packaged air conditioners using Freon 12 or Freon 22 as the refrigerant, thousands of BS&B SEALED TYPE SAFETY HEADS are now in service as the primary relief device.

If you are a manufacturer or user of pressure equipment, we suggest that you consider the non-mechanical relief device—the BS&B SAFETY HEAD. Available in a variety of types, pressure ratings and connection sizes. Investigate now! Descriptive literature and prices will be sent without obligation.

CODE ACCEPTED!

BS&B SEALED TYPE SAFETY HEADS comply with the standards established by the ASA B-9 Refrigeration Code and the ASME Unfired Pressure Code. Many cities are now requiring that air conditioning and refrigeration equipment be protected with safety devices which will comply with these code requirements.

Safety Head Division, Dept. 2-DZ6

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

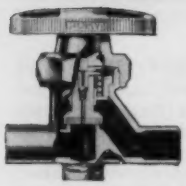
BLACK, SIVALLS & BRYSON, INC.

7500 East 12th Street • Kansas City 26, Missouri

HENRY LINE VALVES really give you something extra

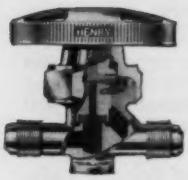
They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES FOR FREON with Exclusive Balanced-Action



STANDARD TYPE

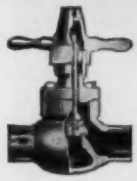
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru ½" F.P.T.



BLUE BANTAM TYPE

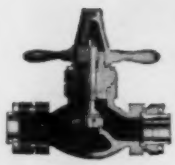
Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

PACKED VALVES FOR FREON Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 4⅛" O.D.

SEMI-STEEL WING CAP TYPE



With bolted bonnets, complete with companion flanges. Available in globe and angle types in sizes 1¼" thru 6". Can be furnished with separate forged brass O.D.S. adapters, or separate steel butt weld adapters. Valves are also supplied with one piece forged steel flanges with F.P.T. connections or slip-on welding connections. Also Globe and angle types with F.P.T. connections, sizes ½" thru 2½".

PACKED VALVES FOR AMMONIA Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2½"—with flange connections 1¼" thru 6"—both flange and angle types.

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

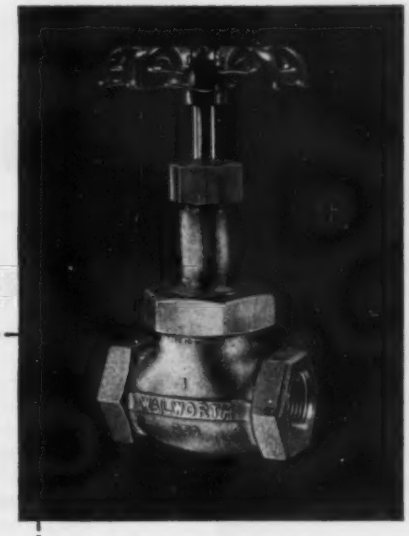
WRITE FOR CATALOGS

HENRY VALVE CO.

Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.



take a good look at the Walworth "500 Brinell" no. 225P Globe

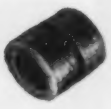
NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

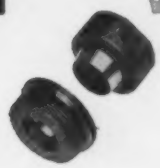


IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.



SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,200 psi.

WALWORTH

valves and fittings

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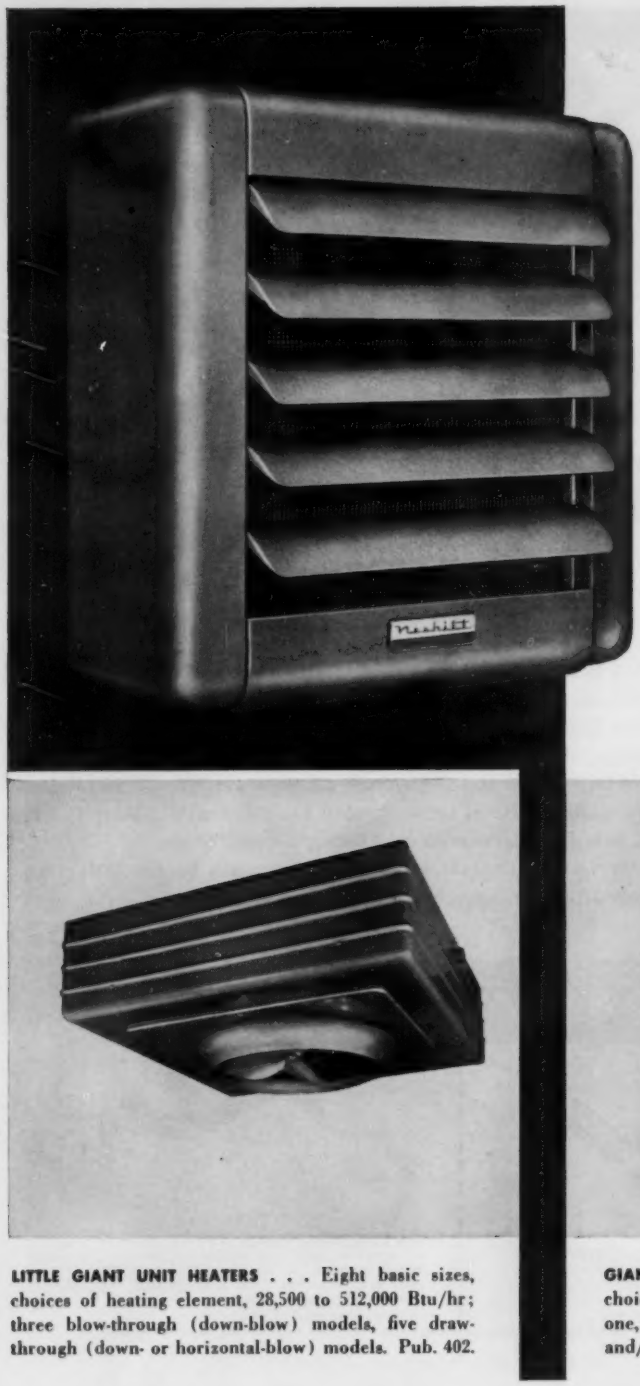
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

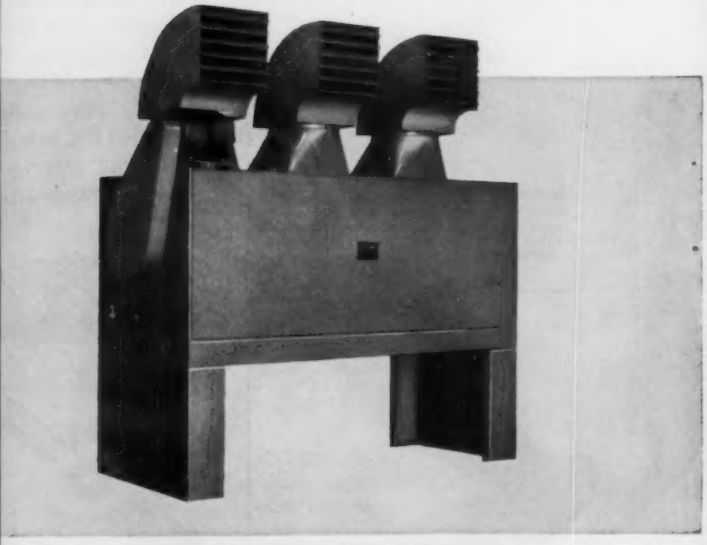


The new

in the Nesbitt line

- ★ Eight basic sizes, 24 models, 15,000 to 335,000 Btu/hr
- ★ Universal coil for maximum performance on steam or hot water
- ★ Coils made for high water capacities and temperature drops
- ★ Low water rates effect savings in piping and installation
- ★ Minimum air-flow resistance reduces noise and operating costs
- ★ Seamless copper tubes and bends; corrugated aluminum fins
- ★ Male pipe connections through casing rear save time and space
- ★ Balanced aluminum fans for quiet, large-volume air delivery
- ★ Heavy gauge, die-formed steel casings for modern interiors
- ★ Deep drawn air intake opening for maximum fan performance
- ★ Easily adjustable louvers, available with double deflectors
- ★ Green metallic hammered finish baked on bonderized steel

LITTLE GIANT UNIT HEATERS . . . Eight basic sizes, choices of heating element, 28,500 to 512,000 Btu/hr; three blow-through (down-blow) models, five draw-through (down- or horizontal-blow) models. Pub. 402.



GIANT UNIT HEATERS . . . Twelve basic sizes each with choice of ten heating elements, steam or hot water; one, two, or three fans; for large capacity heating and/or ventilating; four ways of mounting. Pub. 404.

whenever you have a heating or ventilating problem

propeller-fan heater

of industrial and commercial unit heaters . . .

This wholly new Nesbitt propeller-fan unit heater offers an unusual combination of values in construction, performance, appearance and cost.

Its *universal* heating coil of continuous tube design *performs equally well with either steam or hot water*—an innovation that cuts inventory and warehousing costs in half.

Exact selection is simplified by the choice of 24 models (eight basic sizes) with capacities ranging from 15,000 to 335,000 Btu/hr. Pub. 401.

A careful study of the partial list of special features on the opposite page is recommended. It will explain why these new units are extremely flexible in their application, easy to install, surpassing in performance, quiet, long-lived, economical, and fit for the finest interiors.

The advanced styling and performance of all Nesbitt Unit Heaters is the result of over forty years of progressive engineering and technical improvement—to help keep you in the lead.

SERIES C UNIT HEATERS . . . Five sizes, 34" to 74½" long, each with choice of two steam or one hot-water heating element; two to five fans; recess, semi-recess, and non-recess fronts; 35,100 to 148,000 Btu/hr. Pub. 403.

GAS-FIRED UNIT HEATERS . . . Seven models, 25,000 to 200,000 Btu/hr input, 400 to 2900 cfm; A.G.A. and U.L. approved for all gases; most advanced styling and many features to simplify installation. Pub. 280.

think first of this name

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INDUSTRIAL UNIT HEATERS

Manufactured by

John J. Nesbitt, Inc., Philadelphia 36, Pa.

Sold by Leading Wholesalers. Information on request

What are the men doing?

They are retubing the fuel economizer.

What happened to the old tubes?

Sulphuric acid ate holes in them.

Who put sulphuric acid in the fuel economizer?

Well, nobody meant to. But there was too much sulphur in the coal and when the coal burned some of the sulphur was turned to sulphuric acid.

Why did they purchase the high sulphur coal?

It figured out cheaper on the cents-per-million-BTU basis.

But was it really cheaper by the time they put the new tubes in?

No, it wasn't! And this instance shows that BTU cost is not the only factor to be considered in buying fuel. It's a matter of matching fuel to use and to equipment, and that requires close cooperation between the plant engineer and the purchasing agent.

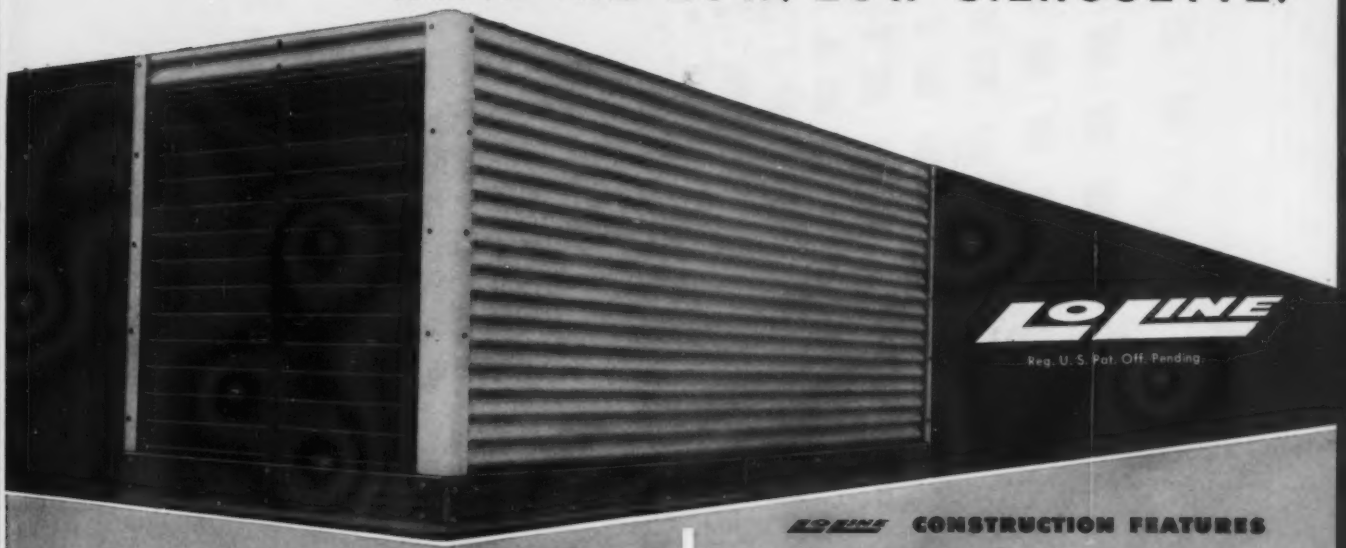
P.S.

There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

THE ALL-NEW PRITCHARD COOLING TOWER— WITH THE LOW, LOW SILHOUETTE!



This new Pritchard LoLine Tower solves two problems for the architect, the building owner and the contractor.

First it meets the trend toward suburban building which has made longer, lower-lined buildings possible. Second, it answers the demands of metropolitan buildings where cooling towers must still be mounted on the roof, by providing a low silhouette which can be easily concealed.

Most important, Pritchard LoLine Towers combine proved new and old features into an efficient, economical cooling unit. This should be no surprise to the many thousands of satisfied Pritchard cooling tower users who have long known that Pritchard is "Industry's Partner for Progress!"

LOLINE CONSTRUCTION FEATURES

FRAMEWORK. Select Heart redwood or better. Surfaced, machine fabricated for precision fit. Each member strongly braced with special connectors for economy and longer life.

AIR INLET LOUVERS. Two sets, one on each side of tower. Each set has slip-fit louvers of cement asbestos board, individually removable from machined slots for easy accessibility to tower.

CASING on the Pritchard LoLine Tower has been carefully designed to make the tower attractive from an architectural point of view. This has been done through the use of horizontally installed, corrugated, asbestos cement board panels and corner rolls which further add to the low appearance. Watertight construction is assured. The pre-fabricated panels are securely bolted to the framework.

MECHANICAL EQUIPMENT. Drive design is simple: V-belt or reduction gear drive supported by rigid hot-dipped galvanized structural members. Fan shaft is stainless steel with self-aligning bearings. Fan, equipped with aluminum blades, is carefully machined and balanced.
ACCESSORIES. A complete line of accessories including ladders, louver screens, fan discharge screens, and basin accessories are available. A new optional feature — internal water supply piping terminating in a flanged connection at the base of the tower — eliminates unsightly exterior water supply piping.

INDUSTRY'S PARTNER FOR PROGRESS

COOLING TOWERS
AIR COOLED HEAT EXCHANGERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

J.F. Pritchard & Co.
OF CALIFORNIA
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Dept. 435, 4625 Roanoke Parkway, Kansas City 12, Mo.

This new LoLine brochure contains a complete description of construction details and mechanical equipment, complete with illustrations and cross-sectional drawing. Use the handy coupon below to send for your copy or copies!

IMPORTANT! Investigate the Pritchard LoLine Tower now! Send for new brochure containing detailed description!

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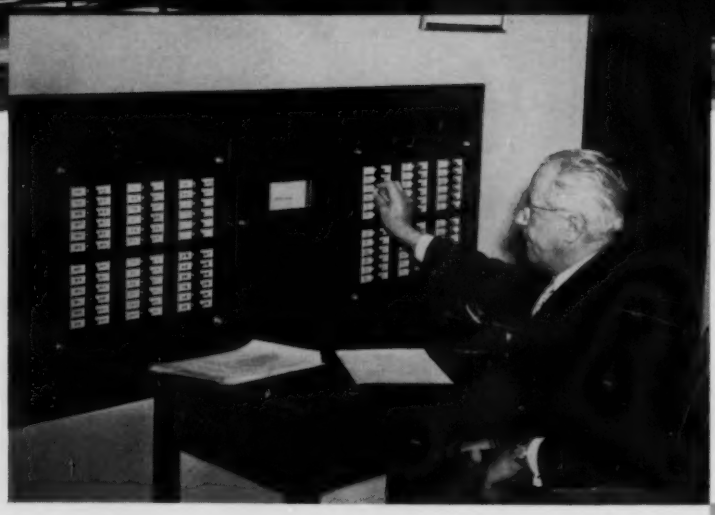


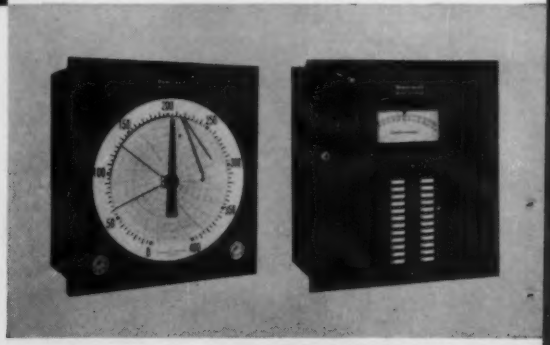
FAHRENHEIT AT FINGERTIPS

144 different temperatures at scattered locations throughout the home office building of Mutual of Omaha and United of Omaha in Omaha, Nebraska, can be checked at the pressing of a button by means of multi-point *ElectroniK* Precision Indicator. The building's mechanical engineering superintendent can get the temperature data he needs quickly and accurately, without moving from the central control panel.

● FOR MEASURING AND CONTROLLING

steam heating coils
reheat coils
sequenced heating and cooling coils
primary air supply systems
chilled water temperatures
space, air, liquid and steam temperatures
differential pressures
air conditioning loads
. . . and many others

● BROWN INSTRUMENTATION INCLUDES . . .



ElectroniK *temperature recorders and controllers*

ElectroniK *multi-point Precision Indicators*

For your air handling system's central control—

it pays to specify ***Brown Instruments***

THE CONTROL centers of your building's air handling system can give you the full benefits of increased efficiency, simplified supervision and peak performance when you utilize Brown recording and controlling instruments.

The ideal companions for Honeywell air-conditioning controls, Brown instruments encompass a diversified line. They cover literally any variable that can be encountered in a complex system . . . temperature, pressure, flow and humidity.

You get plus values in performance. Brown instruments are famous for their ability to deliver high quality, trouble-free service that results in maximum operating economies, power savings and maintenance of comfort. They're the leading choice of industry for process control applications . . . and they've been selected for many major air handling installations.

You get plus values in engineering. Made by the Brown Instruments Division of Honeywell, the world's largest producer of controls, these instruments are backed by extensive know-how in the air handling field. They are custom-fitted to the individual job by men who are thoroughly familiar with the equipment, processes and specifications peculiar to this type of application.

You get a single responsibility for control. Only Honeywell, with its complete family of instruments and controls, can give you the advantage of a single source for all control equipment for the entire air-handling installation.

Your local Honeywell salesman will be glad to discuss how Brown instruments can fit into your system's control center. Call him today . . . he's as near as your phone.

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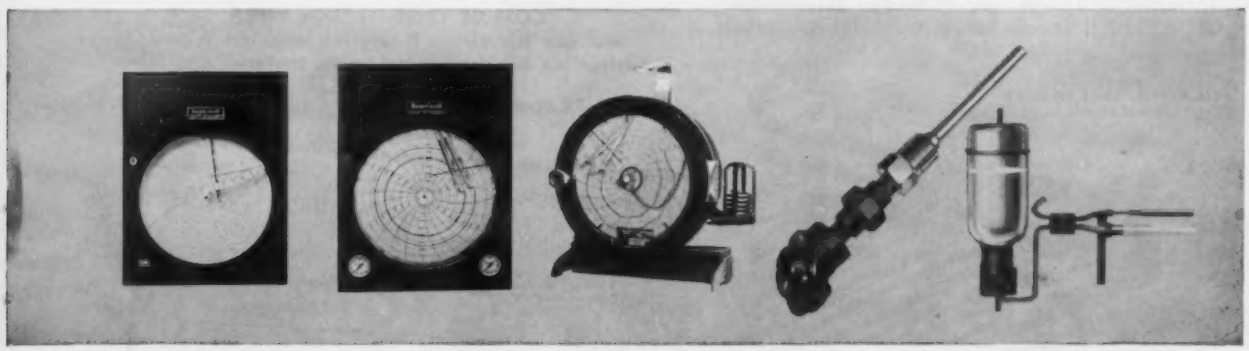

Brown Flow Meters . . . indicating, recording, controlling, integrating

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Resistance thermometer bulbs

Wet and dry bulb assemblies

The Invisible Enemy No. 1

UNDERMINES BUILDINGS, DESTROYS TIMBER; CAUSES COLD, FUEL LOSS, DISCOMFORT IN WINTER.

Each pound of water vapor which escapes from a building in winter robs it of 1,060 Btu's of heat!

It took 1,060 Btu's of latent heat to change that pound of water to a pound of vapor; heat lost to the outside which otherwise would have been profitably employed in heating the building; heat which cost fuel and money to produce.

When that vapor condenses in outer building spaces, it instigates fungus growth and timber rot; peeling paint, crumbling plaster and masonry.

Defend the building by strategically placing barriers of non-corrosive sheets of metal on the WARM side of exterior walls and roof spaces.

"BORING FROM WITHIN"

Bar this invisible enemy—VAPOR—with impenetrable metal which is almost completely impervious to its flow. Each sheet of metal must be of full width, reaching from joist to joist; and of full length, continuous, without breaks every few feet.

These metallic barriers will help expel fortuitous vapor from building spaces (for instance from rain), because where walls or roofs have at least 5 times the permeability of a "barrier", vapor will flow to the outdoors, obedient to Nature's law that vapor flows from areas of greater density to those of less. Since the vapor cannot back up into the building through the wide, long, almost completely impervious, and continuous metal, it will flow out **harmlessly** as a gas, through walls and roofs. (At 32° F. vapor has 1/205,000 the density of water; at 0° F., almost one-millionth its density.)

If building spaces are **defended scientifically** by MULTIPLE sheets of such insulating metals, properly air-spaced apart, condensation formation on or within them is reduced to a minimum.

The temperature of two rooms, 13' x 14', and 8 feet high, could be raised as much as **20° F.** by the equivalent of the latent heat of vaporization of **one pound of water vapor.**

A pint bottle will hold approximately one pound of water. An average family and its activities produce 5 lbs. to 12 lbs. of water vapor daily, consuming 5,300 to 12,720 Btu's. Indoor clothes washing and drying produce an additional 30 lbs. of vapor involving 31,800 Btu's.

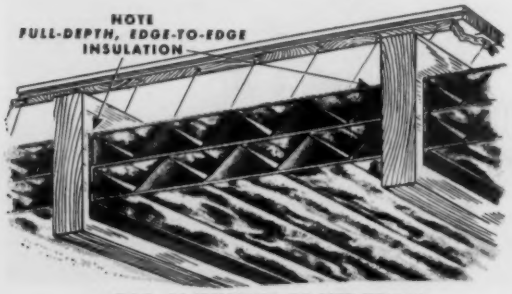
MISSION ACCOMPLISHED

250 MILLION sq. ft. of multiple accordion aluminum have been used in the last 9 years by many of the leading architects, engineers and builders of America, a large part of it repeat orders resulting from satisfactory anti-Vapor and anti-Condensation PERFORMANCE, as well as drastic heat loss reduction.

A new uniform-depth "full-coverage", multiple accordion aluminum insulation (patent applied for) is now on the market.

USE COUPON FOR VALUABLE BOOKLET

The National Housing Agency warns against water vapor. It tells how to cope with some of the problems in an interesting pamphlet, "Technical Bulletin No. 38," based on tests made by the National Bureau of Standards. To obtain a FREE copy at our expense, send coupon.



FOR MAXIMUM PROTECTION

Each sheet stretches from joist to joist and throughout the flanges for further vapor protection and permanent attachment.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation installed in new construction between wood joists, material and labor

Type 6-PS about 10¢ sq. ft. Type 4-PS about 8¢ sq. ft.

Infra Insulation, Inc., 525 B'way., N. Y. C., Dept. H-6
Please send ☐ N.H.A. Technical Bulletin No. 38.
☐ Samples of New Infra.

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THE EDITORS' PAGES

• *WHAT IS IN THE FUTURE for heating, piping and air conditioning? In the year 2055, economists tell us, we shall be able to produce as much in one 7 hour day as in a 40 hour week now. Only five years from now, they say, the average work week will be 37½ hours. But we will be producing more and creating a higher standard of living, requiring more services of heating, piping and air conditioning. Some predictions for the future are given in this issue by I. W. Cotton:* Where Are We Going?

HPAC Contractors Adopt New Name:

. . . Mechanical Contractors

THE Heating, Piping and Air Conditioning Contractors National Association last month continued what has become something of a name-changing trend on the part of various organizations. At its 66th annual convention, held in Houston's air conditioned Shamrock hotel, the members voted without discussion in favor of a new name — the Mechanical Contractors Association of America. The change was proposed as one of the items of the resolutions committee report.

The action is not intended to change the scope or activities of the association, it is understood. It was felt a simpler name would be desirable in many ways.

Edward Jungbert, of Louisville, was elected president of the association, succeeding J. DeWitt Morrow, of Houston. The new vice president is George Hall, and Joseph H. Spitzley is treasurer. Next year's convention is planned for Louisville, either immediately before or right after the Kentucky Derby. Total registration at Houston ran over 500 members, guests and ladies.

Wray M. Scott, a past national president, was given the association's distinguished service award in recognition of his many activities on behalf of the organzation and the industry.

Secretary Lloyd B. Gruman's report — as well as the addresses of convention speakers and various committee reports — stressed the importance of selling during the coming months and the need for keeping costs down by efficiency in all operations. The year "will continue to be highly competitive," Mr. Gruman said.

He announced that the association has appointed an atomic energy committee, of which Arthur F. Nass is chairman, and pointed out that "we stand on the threshold of tremendous activity in the peacetime development of atomic energy." All piping done in connection with atomic energy will be done by piping contractors, such as those comprising the association, he said.

Price-cutting and bid-shopping evils were also given attention. The legislation committee's report regretted that the federal construction contract act has not become law, but the committee felt that progress has been made in establishing that the piping, the plumbing, and the electrical contracting groups should be considered as mechanical specialty contractors "who belong in a category separate and apart from sub-contractors." One reason cited is the much larger proportion of a building's total cost that is represented by the mechanical, plumbing and electrical work today as compared with a few years ago.

Air Conditioning Can Be Owned for Half Price

. . . because of tax rates

BUSINESS AND INDUSTRY can get a whopping bargain in air conditioning with the blessing of Uncle Sam. Non-residential installations are subject to relatively rapid amortization for tax purposes, from 5 to 15 years depending upon the application, as John A. Gilbreath, Westinghouse Electric Corp., points out.

Also, he reminds us, all operating and maintenance costs are deductible expenses. So, with tax rates at 52 percent, or higher, the net cost for both owning and operating is less than half the dollars actually expended. On this basis, he says, the advantages of air conditioning become very attractive to business concerns.

United Association Sponsors Apprentice Tests

. . . finals at Purdue, August 15-18

THE SECOND ANNUAL International Apprentice Contest sponsored by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry will be August 15-18 at Purdue University. Competing will be fifth year plumbing and pipe fitting apprentices who are winners of state or provincial contests.

Two separate contests are being held, one for pipe fitting and one for plumbing apprentices. First, second, and third place winners in each will receive $1000, $500, and $250, respectively.

Written tests will constitute 60 percent of each contestant's score while performance tests will constitute 40 percent. The main objectives of the tests are:

1) To test what has been learned or should be learned from work experience or training received on the job as well as from the related training program.

2) To test knowledge of the related technical information and the application of this information to work on the job.

3) To test practical skills in performance of typical jobs or operations.

4) To test ability to work from typical drawings or sketches.

Cooperating with the United Association in the contests are the Heating, Piping and Air Conditioning Contractors National Association and the National Association of Plumbing Contractors.

To Measure Airborne Particles 1000 Times Faster

. . . new device being developed

MICROSCOPIC AIRBORNE PARTICLES such as dust, smog, moisture, and pollen will one day be measured and counted 1000 times faster than by present methods, predicts Morris A. Fisher, supervisor of fine particles research at Armour Research Foundation. A new instrument, called the aerosoloscope, is being developed which operates on the principle of light scattering, which one observes when viewing microscopic particles in a beam of light.

According to Mr. Fisher, the instrument can count and measure particles ranging in size from 1 to 64 microns, at the rate of 100 per second. Electrical impulses created by a photomultiplier tube, as it detects the scattered light and determines the size of each particle, are transmitted to a set of 12 dials. The first dial records the number of particles 1 to 1.4 microns in diameter. Each succeeding dial records slightly larger particles than the preceding one.

No More Monoxide Than 30 Years Ago, Tests Show

. . . no health problem seen

CARBON MONOXIDE from auto exhausts is not a health problem in either Los Angeles or Detroit for motorists, pedestrians, or the general population, reports the Industrial Hygiene department of General Motors Corp. Hundreds of air samples in both cities were analyzed by members of the department. They confirmed conclusions of investigators who had made tests in several large U. S. cities 25 to 30 years ago, and who had found no problem.

Even on smog days in Los Angeles, the average monoxide ratings, although higher than on non-smog days, were far below any level that industrial hygienists consider a health problem, they said.

Despite the tremendous traffic increase, no significant increase in carbon monoxide was detected. This was attributed to the fact that modern cars exhaust about one-half as much monoxide as 1927 cars did.

Test stations were standard automobiles outfitted with sensitive instruments to detect varying amounts of carbon monoxide in the air. They traveled in light, heavy and dense traffic in downtown and residential areas. Intake tubes were arranged to register the exposure for motorists and for pedestrians at the curb. Other tests at fixed locations 150 ft above downtown streets revealed much less carbon monoxide than at street levels.

Corrosion of Underground Bolts Now Predicted

. . . by electrical measurements

CORROSION RESISTANCE of bolt materials used underground can be predicted by electrical measurements made in the laboratory, according to a study by the National Bureau of Standards. Certain bolt materials can be protected against corrosion by making them cathodic to the structures which they fasten.

Bolts and structures of the same materials should corrode at the same rate, but it is believed that the many sharp edges on the surfaces of bolts accelerate the corrosion rate. Also, corrosion may be further accelerated because of increased galvanic action when the soil around the bolt is packed more tightly than the earth around the adjacent structure.

Release New Section 8 of Code for Pressure Piping

. . . safety standards revised

A REVISED SECTION 8 on Gas Transmission and Distribution Piping, ASA B31.1 has been released by the American Society of Mechanical Engineers. It establishes safe standards in the design, fabrication and installation of gas transmission and distribution pipe lines. Included also are gas compressor stations, gas metering and regulating stations, gas mains and gas services up to the customer's meter.

Heating and Ventilating Cost for N.Y.C. Buildings

. . . is $0.157 per sq ft

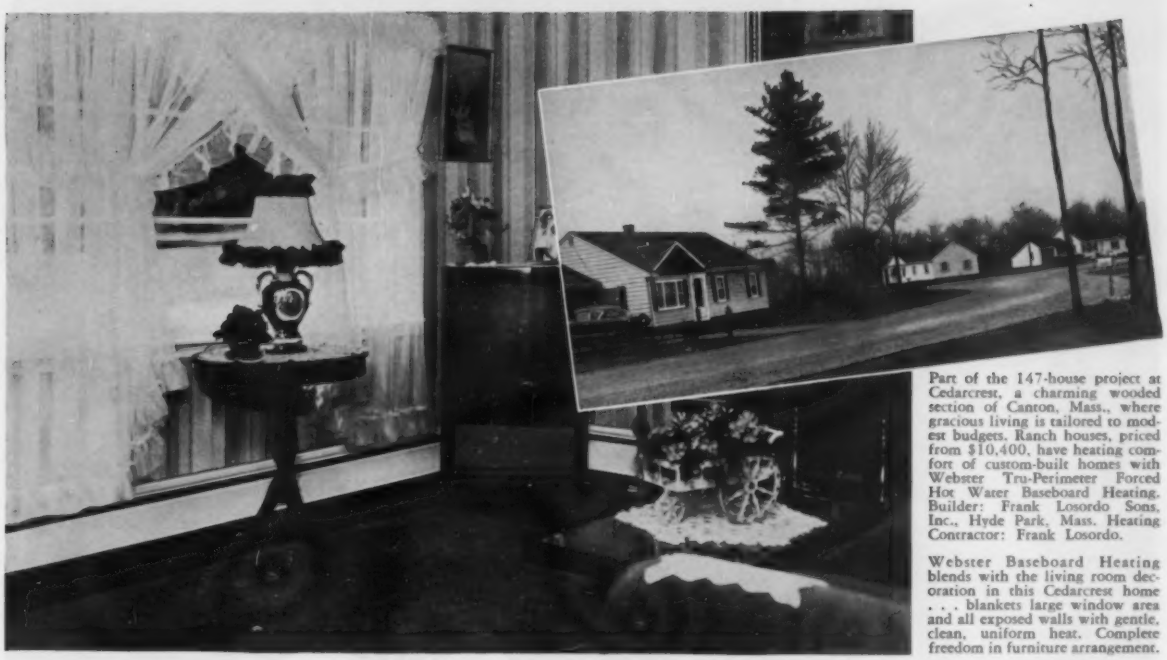
HEATING AND VENTILATING services in the 61 public buildings under the New York city department of public works cost $0.157 per sq ft over a recent 12 month period, according to Commissioner Frederick H. Zurmuhlen. For the six months ending December 31, 1953, the cost was $527,810; for the six months ending June 30, 1954, $626,191. The total gross floor area is 7,359,454 sq ft.

Charged with the heating, air conditioning, ventilation, custodial care, maintenance, and repair of these buildings, scattered over the five boroughs, is the Division of Building Management. Under this, the Bureau of Mechanical Maintenance and Operation is responsible for the maintenance and operation of all heating plants, ventilating and air conditioning equipment.

One of the serious problems is the outdated electric wiring. The installation of air conditioning units, modern business machines, and improved lighting have strained existing facilities and caused a backlog of wiring work.

"Quote"

"The air conditioning industry is one of the most dynamic in America. It is growing at a much faster rate than our economy as a whole, and the people of America have finally become 'air conditioning minded'."—*John A. Gilbreath, Manager, air conditioning division, Westinghouse Electric Corp., in a recent speech.*



Part of the 147-house project at Cedarcrest, a charming wooded section of Canton, Mass., where gracious living is tailored to modest budgets. Ranch houses, priced from $10,400, have heating comfort of custom-built homes with Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Builder: Frank Losordo Sons, Inc., Hyde Park, Mass. Heating Contractor: Frank Losordo.

Webster Baseboard Heating blends with the living room decoration in this Cedarcrest home . . . blankets large window area and all exposed walls with gentle, clean, uniform heat. Complete freedom in furniture arrangement.

$10,400 Ranch Home with Webster Tru-Perimeter Heating

Frank Losordo Sons, Inc., builds these three-bedroom ranch homes, size 36x24 feet, to sell for $10,400, with Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Says Frank Losordo, "The low cost operation of a good heating system is a big sales factor."

Heating is gentle and draft-free . . . Picture window areas are completely comfortable . . . There's no loss of floor or wall space, no "heating" in sight, nothing to interfere with furniture decoration . . . Wasteful overheating is avoided.

Quality operative builders like Frank Losordo Sons, Inc., have found that Webster Tru-Perimeter Forced Hot Water Baseboard Heating meets their requirements. It is economical to install. There is a minimum of piping, no air ducts, radiators or registers. The heating unit combines the heating element and heating main, and is concealed behind unobtrusive baseboard. Simplified design means fewer parts, less time and money spent on the job.

Send today for 16-page illustrated technical bulletin on Webster Baseboard Heating . . . Ask for Bulletin B-1602.

Address Dept. HP-6

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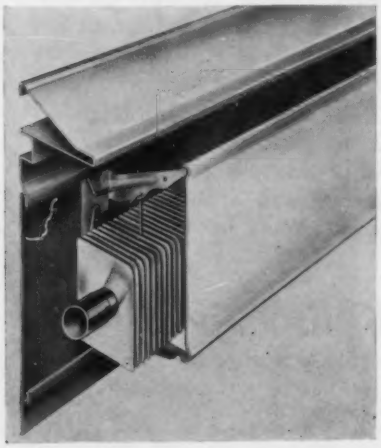


Cut-away view showing Webster Tru-Perimeter Forced Hot Water Baseboard Heating. Note its simplicity.

Webster

TRU-PERIMETER FORCED HOT WATER BASEBOARD HEATING

AND **Webster Walvector®, standard and custom for Tru-Perimeter Heating; Convectors; Radiator Valves, Thermostatic and Float and Thermostatic Traps, Dirt Strainers, Double Service Valves, Boiler Return and Vent Traps, Lift Fittings, Expansion Joints, Hot Water Heating Specialties and Controls; Webster Moderator Controls for Steam Heating, Gas, Steam and Hot Water Unit Heaters. Data on request.**

p-k

PUTS CHILL ON RESEARCH LAB PROBLEM

for Celanese® CHEMICALS

John Armstrong (right), president of Delta Engineering and Conditioning Co., East Orange, N. J., and A. G. Scott, Celanese plant engineer, discuss final details of the installation just prior to putting the system into service.

To solve a problem, first get to the center of it; and that's just what the engineers of Celanese and Delta Engineering did at the Celanese Corp. of America's Summit, N. J. research lab.

The nub of the problem called for controlled temperatures to be made available throughout the building for research and pilot plant work. The solution centers on a **p-k** brine storage chiller centrally installed in the basement. Around it is the system of the closed-circuit type, composed of compressor, pumps, brine make-up and mixing tanks, with all instruments and controls mounted in a centrally located control panel.

Elimination of the conventional, open roof tanks means a *clean* system, while careful integration of units ensures ease of maintenance. This compact **p-k** chiller installation, requiring only minimum insulation and floor space, *is factory assembled in the 780 gal. brine storage tank.* From here, brine is circulated throughout the building at −15°F. to −10°F., with Freon 22 used as the cooling medium.

We believe that you, like the Delta Engineering and Conditioning Co., will find it easy and profitable to work with **p-k** specialists in the design, manufacture and application of heat transfer equipment. Write for information.

The Patterson-Kelley Co., Inc.

760 Burson Street, East Stroudsburg, Penna.

2870

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston • and other principal cities.

"OPEN FOR DISCUSSION"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Pressure Loss in Round Duct Elbows Needs Further Testing for General Use

I WISH TO THANK both R. M. Conner and R. D. Madison for their remarks in the April HPAC on my article, *How Much Pressure Loss in Round Elbows?*, published in the March HPAC.

Both seem to desire further information on other elbows. Our desires in this matter were satisfied with the tests we reported because we have standardized on this one type of elbow. I agree that other similar tests would be of general use, and I strongly recommend that further testing be done.

Mr. Conner seemed concerned over the accuracy of the instruments used in the test. We have been very pleased with the pitot tube and have consistently been able to reproduce readings with an accuracy of better than ± 0.02 in. of water gage. Comparison of the data taken ahead of and behind the elbow showed remarkable agreement.

I am not familiar with the application with which Mr. Conner is concerned, but I feel his requirements differ considerably from ours. The units used in expressing the data are the units we use in dust control and low velocity conveying. Perhaps equivalent feet of duct would be easier to work with if all units of the system were in equivalent feet of duct.

R. K. GUTHRIE
Mechanical Engineer
The Procter & Gamble Co.

Recommends Dual Design Conditions for Air Conditioning Humid U.S.

IN THE ARTICLE, *Weather's Effect on Air Conditioning Load*, by John Everetts, Jr., in the May HPAC, the author well illustrates the importance of a thorough knowledge of local weather conditions in choosing design temperatures for air conditioning loads. This is a fact which should not be overlooked by engineers who design air conditioning systems for buildings outside of their own locality. Also, the choice of design temperature conditions for outside air is a complex problem, and, in my opinion, is not properly considered by many design engineers.

A point which the author might have made, based on the conclusions which he presented, is that a dual set of design conditions are sometimes indicated and necessary. For example, air conditioning systems for large buildings in the more humid areas of the U. S. are frequently designed with separate conditioning systems which cool and dehumidify 100 percent outside air for ventilation. This conditioned ventilation air is then mixed with return air from the central system or is used in other ways in the building. The choice of equipment for this ventilation air conditioning system should be based on simultaneous wet bulb and dry bulb conditions that will actually be experienced, and of such value that they will be exceeded by some predetermined percentage of time or magnitude. On the other hand, the DB temperature on which the room sensible heat load must be based could easily be, and probably would be, an entirely different figure from that chosen for the unit which admits 100 percent outside air.

In Houston, where it is common practice among a large group of design engineers to use design conditions of 95 F DB and 80 F WB, this particular combination of conditions occurs very infrequently. A more realistic figure for the ventilation air unit design conditions would be, perhaps, 92 F DB and 80 F WB. This condition reguires a higher latent heat capacity in the cooling coil and must be taken into consideration when humidity conditions within the building are significant.

I. A. NAMAN
Consulting Engineer

Warm Air Floor Panel-Convection System Said to Avoid Complaints

IN REFERENCE to G. L. Gendler's article, *Warm Air Floor Panel-Convection Combined to Heat New School*, in the December 1954 HPAC, I would like to offer the following remarks. These comments are based on statements made by heating and ventilating contractors during discussions of school heating problems at Indoor Comfort Conferences held in all parts of the country during the past eight years by the National Warm Air Heating and Air Conditioning Association. Although the system described by Mr. Gendler is in the mild-climate area of California, the following comments cover the more rigorous New England winters and many in-between localities across the country as well.

1) In a school room having a concrete slab floor laid directly on the ground, 100 percent convection heating brings complaints of uncomfortably cold floors. These complaints are made especially in rainy weather when pupils must sit for several hours with wet shoes planted on relatively cold concrete.

2) With a similar floor, 100 percent floor panel heating often results in a floor much too warm for comfort under design temperature conditions. Parents then complain that the children's feet sweat during school hours and they "catch cold" too easily when they go out.

3) With only floor panel heating — regardless of whether the floor structure is heated with warm air or hot water — the mass of concrete changes temperature too slowly to properly maintain comfortable school room temperatures during periods of rather wide variations in the heat demand due to sudden outdoor weather changes.

4) Teachers complain that when the floors are either uncomfortably warm or chilly, the pupils become restless and less attentive.

The type of system described by Mr. Gendler would seem to guard against such complaints as the above.

GUY VOORHEES
Technical Secretary, National Warm
Air Heating & Air Conditioning Association

Forced Hot Water Floor Panel Heating Seen Answer to Slab School Problems

THE ARTICLE, *Warm Air Floor Panel-Convection Combined to Heat New School*, by G. L. Gendler, in the December 1954 HPAC, seems to emphasize a few of the many advantages of installing forced hot water systems in new schools, especially those built on concrete slabs.

The problem of cool floors in school rooms having a concrete slab floor directly on the ground and using a 100 percent convection heating system is not encountered when a floor panel is installed. Floor panels are sometimes said to be too warm and to cause children's feet to perspire when the system operates at design conditions. However, a floor panel system, regardless of the heating medium when properly designed, takes into consideration the floor surface temperatures at the outdoor design temperature for the system.Therefore, when the system is operating under design conditions, the surface of the floor is not above normal.

For the past five years I have conducted the I-B-R School of Modern Heating in a wide area of the U. S. One of the subjects taught in the I-B-R School is floor panel systems with forced hot water. The discussions have indicated that regardless of the rapid changes in heating requirements in some areas, the control manufacturers can supply equipment to govern the operation of a properly designed forced hot water floor panel so that the indoor temperature is maintained at all times.

As to the comparative costs of installation, the article stated that the cost of the warm air floor panel-convection installation was "approximately the same as that of a quality hot water floor panel system with individual room control." In other words, for approximately the same initial cost, a quality forced hot water panel system could have been installed, which would have overcome the problems of heating a school built on a concrete slab. In addition, each room would have control of its temperature. Then there is the cost of maintenance. The warm air system which was installed utilized two furnaces. A forced hot water system could have used only one boiler. The cost of upkeep for two heating units is greater than for one unit.

A. L. WALES
Technical Secretary,
The Institute of Boiler and Radiator Manufacturers

"Sound Trap's Response Varies on High Velocity Systems"

IN THE ARTICLE, *Handbook on High Velocity Air Distribution Design*, by C. Milton Wilson, in the November 1954 HPAC, there was illustrated a design of a sound trap or muffler proposed, on which I should like to comment.

The proposed muffler operates as a resonant tuned duct. The system provides maximum attenuation over a very narrow resonant frequency band. Its acoustical response will vary, both frequency-wise and attenuation-wise, sharply as a function of D, the duct dimension. A different response attentuation must be predicted for each new duct dimension. The attenuation spectrum of such a device is very narrow in breadth, frequency-wise, and this inherently limits its use.

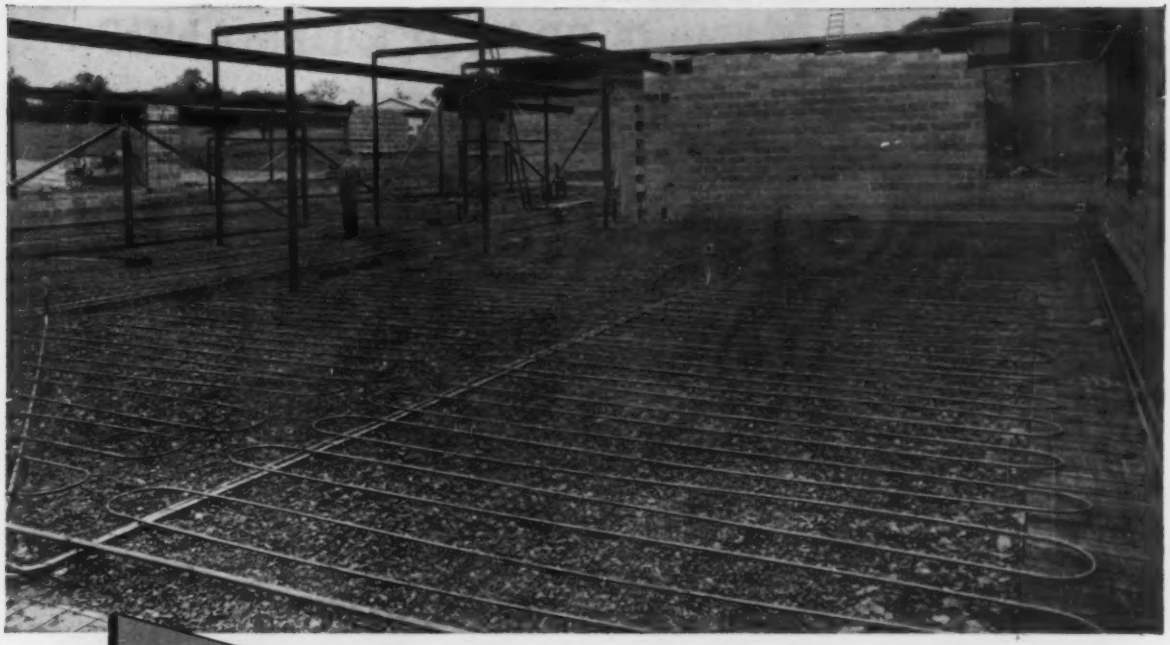
Centrifugal and vaneaxial fans for high pressure air conditioning systems produce noise which is very broad band in its frequency character; that is, these fans will produce substantial acoustic energy from 50 cycles to 10,000 cycles. A simple resonant filter, such as shown in the article, may provide substantial attentuation at single frequencies such as 200 cycles, but provide little or no attenuation at 100 cycles or 300 cycles. Use of such a muffler in high pressure air conditioning systems is based on the false premise that the fan is producing a pure fundamental tone of sound whose frequency is based on the number of blades times the rpm divided by 60. In fans where the top speed of the fan blade is below Mach. 0.2, the turbulence noise from vortices peeling off the fan blade surfaces themselves predominates in noise production. This action produces broad band low and middle frequency noise which cannot be adequately eliminated with a resonant type filter such as described.

RICHARD D. LEMMERMAN
Vice President
Industrial Sound Control, Inc.

MANCHESTER ELEMENTARY SCHOOL

Manchester, Missouri

Architect: CHARLES W. LORENZ, Kirkwood, Mo.
Contractor: JUENGEL CONST. CO., St. Louis, Mo.
Radiant Heating: BAGLEY & COMPANY, Inc., Robertson, Mo.
Revere Distributor: GRINNELL COMPANY, Inc., St. Louis, Mo.



Another case of COPPER where it counts!

TWO VIEWS of the radiant Panel heating layout before concrete slab was poured. Floor area over 17,000 sq. ft. System was imbedded in slab 4". Gravel fill is 6" deep. Coils are 12" OC. System is divided into 4 zones, with all supply and return lines also of copper. Note edge insulation at right in large photo.

Radiant Panel Heating fits perfectly into the growing trend to 1-story school construction. It means warm floors, no drafts, and a healthier atmosphere for scholars. To the architect radiant panel heating means greater latitude in design, more usable space for the money. And for the user it means greater heating efficiency, lower redecorating costs and less cleaning and maintenance than when old-fashioned heating methods are used. The ideal material for panel heating is copper. For no other metal or alloy has all the desirable construction characteristics of this "ageless" metal.

To the contractor, the use of Revere Copper Water Tube means easy bending and handling . . . its long 60′ lengths require fewer fittings, the solder fittings used eliminate the need for welding, wrench work and thread cutting, while its lasting, non-rusting qualities have been proven through the centuries. Even being buried in a concrete slab doesn't bother enduring copper. Copper is the metal you can trust.

Keep out of trouble, protect your reputation for quality work . . . use Revere Copper Water Tube for air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste stack and vent lines, processing lines. See the Revere Distributor nearest you today. And, if you have a technical problem, he will put you in touch with Revere's Technical Advisory Service.

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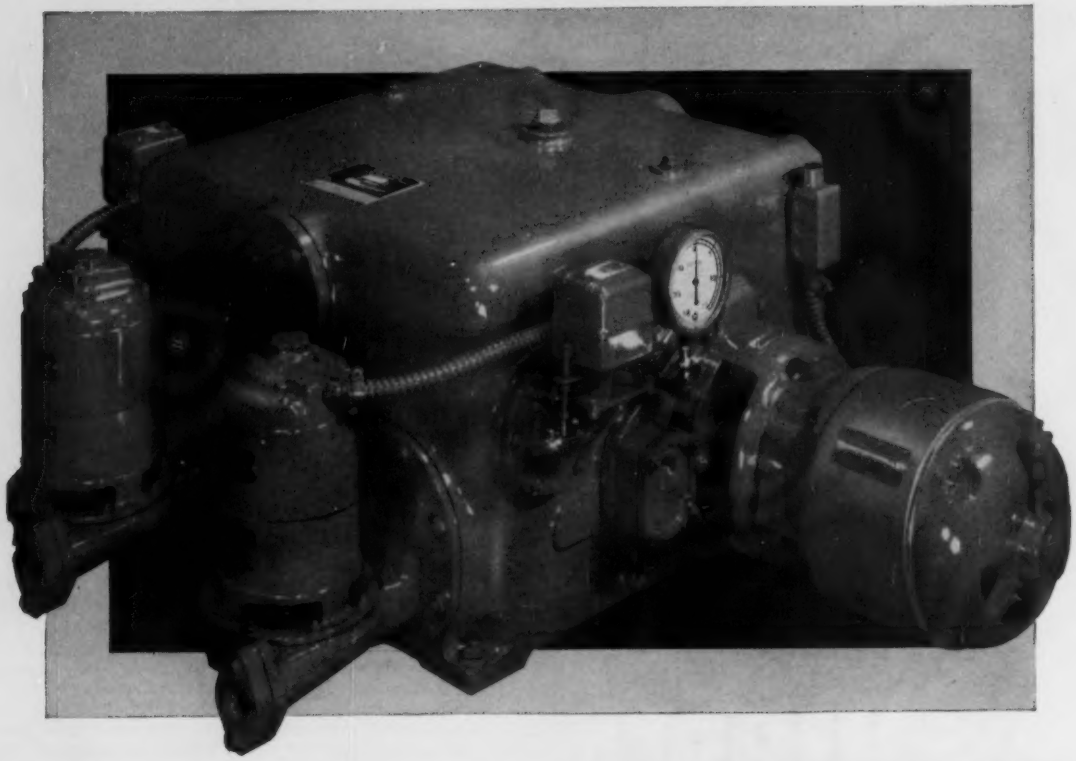
THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY

437 WILSON, SO. NORWALK, CONN.

Where Do We Go from Here?

. . . in heating and air conditioning

EXPERIMENTAL MODEL of an all electronic cooling unit, demonstrated here by Nils E. Lindenblad of RCA Laboratories, is indication in 1955 that the wheel of progress still has wings. (Photo courtesy RCA)

By I. W. Cotton

• **Constant progress is the keynote in heating and air conditioning. Despite successful improvements and higher standards, at no time can we say "we have arrived." There is more progress being made all the time. And undoubtedly more will be made in the future than has been made in the past.**

This being the case, here are some predictions of things to come in the next 40 years. The author invites you to have some fun by shooting holes in his predictions and to make some predictions of your own.

WE HAVE COME a long way in providing comfortable and healthy indoor environments. Progress has been continuous and has extended throughout the life span of the old-timers in our midst.

Reflecting on how things are today and how they used to be, naturally makes us wonder how things will be in the future. Many will inquire, "What possible improvements can lie ahead? Haven't we about reached

The author has many years of experience in heating and air conditioning. An active member of the American Society of Heating and Air-Conditioning Engineers, he has served as chairman of its Committee on Research and is currently a member of its Council.

the millenium in warmth in winter and coolness in summer?"

Had you asked that same question 10 years ago, the same tendency to feel that the ultimate was in sight would have been apparent. Likewise, 20 years ago.

If asked 30 years ago, the question would have applied only to heating. But many at that time would have felt that heating had attained its zenith.

Heating Men Were Experts

Forty years ago this feeling would have been even more so. Those were the days when heating men were experts. They could install systems that would heat reasonably tight buildings of all sorts to 70 F, all over, with zero outdoors. That was before the time of the closed automobile. Folks still wore long woolen underwear and thick suits and dresses to combat the hours of exposure to bitter cold, which just about everybody had to endure. Since they removed heavy coats but didn't change clothes when going indoors, they were dressed so warmly that 70 F was enough.

Success in providing 70 F indoors at zero outside qualified a man as an expert. He didn't have to master too much. He used Mill's rule in figuring steam or hot water radiation, then doubled the boiler size and hooked on to a good flue. He insisted on a deep basement for the "hot air" furnace, giving the warm air leads a good pitch upward, applying a little judgment in increasing the leader size for the longer runs, and taking plenty of cold air returns from outside walls. Behold! Another satisfied customer bragging that he could hit higher than 70 F at below zero with his job.

For soft coal, give them bigger than double size furnaces or boilers and they had what it took to bank a big fire insuring warmth for many hours.

What could be better than such perfection? Comparisons were with the old Franklin stoves or base burners, which burned 'em up at close range but let them freeze in the other rooms and in the drafty corners of the rooms directly served. Came the heating expert, flooding the entire area with warmth, with few if any cool spots anywhere. Perfect heat!

Progress Depends on Tools

For extra good tools, the heating man had the new type electric battery thermostat with its hand wound spring or weight regulator, opening or closing the furnace or boiler dampers, thus maintaining the temperature within a couple of degrees of the setting. The mercury actuated pressure generator made it possible to install hot water heating plants with unbelievably small pipes. Newer still, the basement expansion tank — a pressure generator — also eliminated the freeze-ups invited by the earlier tanks-in-attics. And the steel furnace with its extended surface drum was widely advertised to prevent the intrusion of combustion gases into the air plenum section via leaking joint packing.

Bigger buildings could now have the modern two pipe steam or vacuum system, with top supply radiator valves which could be individually modulated for giving each space its own simple heat control.

The era of central heating was here, the jobs being installed were nearly perfect. Satisfaction and complacency reigned. True, a few bolder idealists in the heating fraternity did a bit of dreaming. They thought how nice it would be if somebody could only discover how to burn oil without a wick and end the drudgery of stoking in the coal and getting rid of ashes.

What We Had by 1925

In the 10 years following, we went through World War I. For two of the 10 years nobody was thinking about improvements, yet look what we had by 1925:

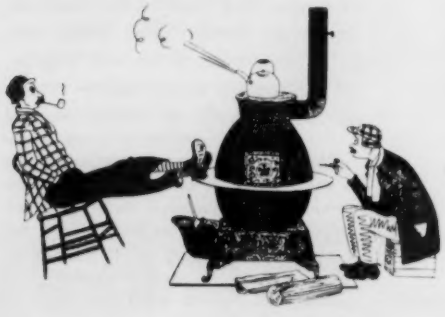
- The domestic oil burner.
- Lightweight unit heater. Somebody turned steam into an automobile radiator, blew air through the coils and fins and had 500 sq ft of radiation requiring only a little space.
- The furnace fan, to liven up the circulation of warm air systems or individual long-run leaders.
- Efficient boilers, which were easy to install.
- The sensational new mechanical cooling system, costly to install and expensive to operate but intriguing in its possibilities.

This last wonder item alone erased most millenial ideas from our minds. Heating men were determined that this new cooling business should become a part of the heating business. The new horizons were to be ours.

We Were Complacent in 1935

In 1935 we were right back at the complacent stage we had enjoyed in 1915, this time with cooling as well as heating. We now had:

- Domestic stokers.
- Outdoor-indoor type thermostatic controls.
- Circulating pumps for hot water heating, with zone controls.
- High differential vacuum pumps and systems, using 212 F or hotter steam in bitter weather, down to 150 F on mild days.
- Unit ventilators for schools and offices.



"What improvements can lie ahead—haven't we reached the millenium in comfort?"

• Lightweight cast iron radiators, which looked like toys, and convectors with enclosures like fine furniture in appearance.

• Efficient, lightweight heat transfer and condenser coils.

• Cooling going in everywhere, using refrigeration in the warmer regions, but using well water or even city water as the cooling medium in spots having sufficiently cold water.

• Vastly improved refrigerants.

• Directional flow fin type air diffuser grilles for eliminating chill drafts in cooled spaces.

• ½ and ¾ ton cooling units which backed up against windows and used outdoor air for compressor cooling, outdoor air for simple ventilation, and either outdoor or recirculated air for positive cooling.

• Air filters, available in many types and at reasonable cost.

There were others, but these illustrate the almost perfect things we could do with the almost perfect tools available, back in 1935. Had the question been asked then, *Where Do We Go from Here?*, many a sincere, capable, and experienced head would have shaken doubtfully at the need for going very much anywhere at all. We were there.

Or were we?

Progress by 1945 the End?

Certainly, 1945 wouldn't have said so about 1935. Too much had happened, in spite of another World War, which took twice as much time from normal pursuits as the 1917-18 edition.

In 1945 we had:

• An entirely new concept of heating — and maybe cooling — radiant or panel.

• Finned pipe radiators.

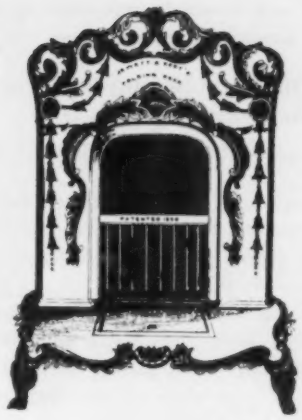
• Improved cooling towers for conserving cooling water for compressors.

• Crystallization of the dream to heat by reverse cycle refrigeration, the heat pump.

• Gas fired unit heaters, previously developed but now made practical.

• Direct oil or gas fired space heaters.

• Small air cooled individual room



coolers for window installation, tiny by comparison with the 1935 variety.

• Baseboard radiation for hot water heating.

• Electronic controls.

• Combustion controls to insure flame efficiency.

• Mechanical dehumidifiers.

Many other new and improved items were there. Engineers could rightly feel in 1945 that they had just about everything to offer in the way of end results. Add to this the feeling that wartime inventiveness and secret equipment would now be released and would quickly provide the improvements and refinements which would push us over the final hurdle to perfection.

Did it work out that way?

Not quite.

New Horizons Seen in 1955

The improvements and refinements came along, but also some new items, which brought with them totally new vistas and horizons.

In 1955 we have:

• Perimeter heating and cooling, using air, to add to the earlier successful hot water baseboard radiation.

• Air to air heat exchangers, for extracting costly Btu's from exhaust air and transferring the heat or cold to the replacing outdoor air.

• Electric radiant blocks for spot or small space heating.

• High pressure air systems, using small ducts and having efficient velocity and noise reducing branch takeoffs for releasing the air into the space quietly and at low velocity.

• Snow melting.

• High temperature hot water — 600 F — with pumps and heat exchangers for efficient circulation for heating large buildings.

• Convectors with heat exchangers and mixing valves for room heating and cooling.

And our knowledge of physiological reactions has progressed. We know better than ever the exact benefits of our heating, cooling, and ventilating jobs. We know that we are offering real comfort along with more healthful environments. We know that human bodies do not change in fundamental functions, and that bodily responses to heat, cold, and air contamination will remain as at present.

Why, then, should we not consider that we are offering the ultimate, today, in indoor climate?

We might think so if we did not remember that 40 years ago we had attained near-perfection in heating indoor spaces, but had not yet dreamed of automatic heat or of cooling. All of the new things developed since then have brought with them not only their own vital individual contributions but have also simultaneously opened up entire new vistas and horizons, so that today no man had better proclaim that there isn't any place left to go. He had better admit that there are countless places to go and busy himself in getting on the road, ready to travel.

Travel where? Well, reader, here is a list of one man's ideas about where we go from here in the next 40 years.

What Will Happen by 1995?

By 1995 in the U. S. the following progress will have been made:

1 Year 'round air conditioning—

Year 'round air conditioning will be installed in 88 percent of all residential units; 100 percent of all hotels, motels or other hostelries built since 1955; 95 percent of all commercial units; 92 percent of all industrial buildings; 100 percent of all amusement places, coliseums and other public assembly units; 100 per-

cent of all churches; 100 percent of all schools and higher education units.

2 Purified, odor free, medicated air—

Purified, odor free and medicated air will eliminate infections in all air conditioned environments.

3 Healthful lighting a part of indoor environment—

Indoor climate will include healthful lighting worked out by the cooperation of heating, air conditioning, and lighting engineers. The best conditions prevailing in brilliant sunshine and mountain fresh air will apply indoors. No rainy day gloom!

4 Separate perimeter air systems for heating, cooling, and ventilating—

Heating load and cooling loads will be met by perimeter air. Ventilating requirements will be met by separate systems, automatically controlled to meet exactly the spot requirements for clean, odor free and medicated air.

5 Heating to be done by the sun—

Most heating will be provided by the sun, directly and through storage units operated automatically, accumulating and dispensing Btu's.

6 Cooling to be done by storage type cooling sources—

Very inexpensive cooling will be available through the utilization of storage type heat sinks — or cooling sources — for refrigerating equipment.

7 Personal heating or cooling to be done by electric blanket type garments—

Individual garments similar in principle to 1955 electric blankets, but capable of providing either heating or cooling, will be widely used. They will receive heat or cold from remote central storage points by metered electronic impulses. They will provide outdoor comfort in all seasons and will enable individuals who like indoor environments somewhat warmer or cooler than average to regulate for personal preferences. They will be lightweight and comfortable.

8 Solar energy at a moment's notice—

Heating and air conditioning systems will be able on short notice, when necessary or desirable, to cast loose from terrestrial energy and go directly on solar.

Now that I have made these predictions about what we shall have, the next question is, how do we get it? For answers to the latter, I refer you to the U. S. Patent Office, along about 1990. *Or peek into the brain of that starry eyed young assistant who likes his work and gets a real bang out of making people comfortable in spite of winter's frigidity and summer's torridity.*

Now I'd like to invite you to send in your evaluation of my predictions, using the tear-out grading form accompanying this article. Pull no punches. I have survived many caustic rejections of glittering brainstorms and have also had the surprising shock of seeing a rejection rejected by the public.

Ideas are the main thing. Your gradings and comments will be a good start in acquiring them. The grades and some of the comments will be published.

Also, you are invited to submit any predictions of your own. I believe the sum total of these predictions will form an intriguing commentary on the degree of practical optimism prevailing among the practitioners of heating and air conditioning today.

Evaluation Form

PREDICTIONS for 1955

Progress in Heating and Air Conditioning

Tear out and mail to:

THE EDITORS, Heating, Piping & Air Conditioning
6 N. Michigan Ave.
Chicago 2, Ill.

Here are my grades for I. W. Cotton's predictions. Please send them along to him.

A — Hare Brained Hallucination
B — Far Fetched Possibility
C — Amusing Absurdity
D — Colossal Concept

1 Year 'round air conditioning— _____
2 Purified, odor free, medicated air— _____
3 Healthful lighting a part of indoor environment— _____
4 Separate perimeter air systems for heating, cooling, and ventilating— _____
5 Heating to be done by the sun— _____
6 Cooling to be done by storage type cooling sources— _____
7 Personal heating or cooling to be done by electric blanket type garments— _____
8 Solar energy at a moment's notice— _____

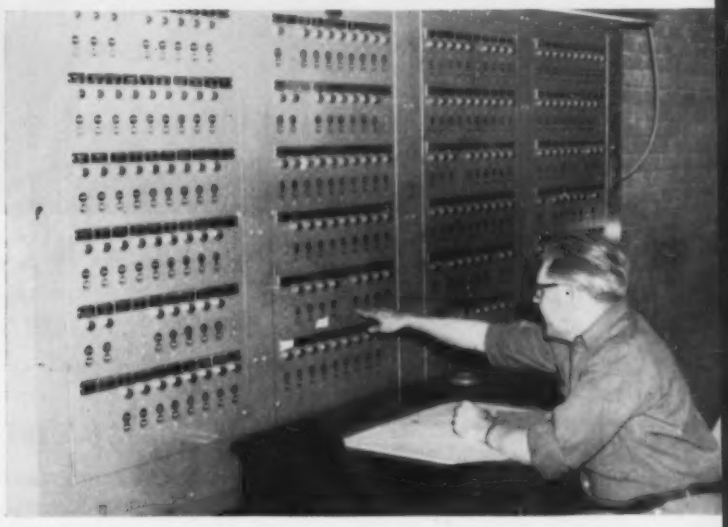
COMMENTS: _____

_____

_____

Signature (optional) _____

CENTRALIZED CONTROL PANEL for 230 fans at the Merchandise Mart has 30 start-stop push buttons and pilot light stations, each color coded for varying starting and stopping times



Centralized Fan Control to Save Mart $16,137 Annually

. . . . newly installed system cuts power, labor and other costs

By Walter A. Stahl
Operating Manager
The Merchandise Mart

CENTRALIZED FAN CONTROL recently installed in Chicago's Merchandise Mart is estimated to save $16,137 per year. Breakdown of the expected annual savings is as follows:

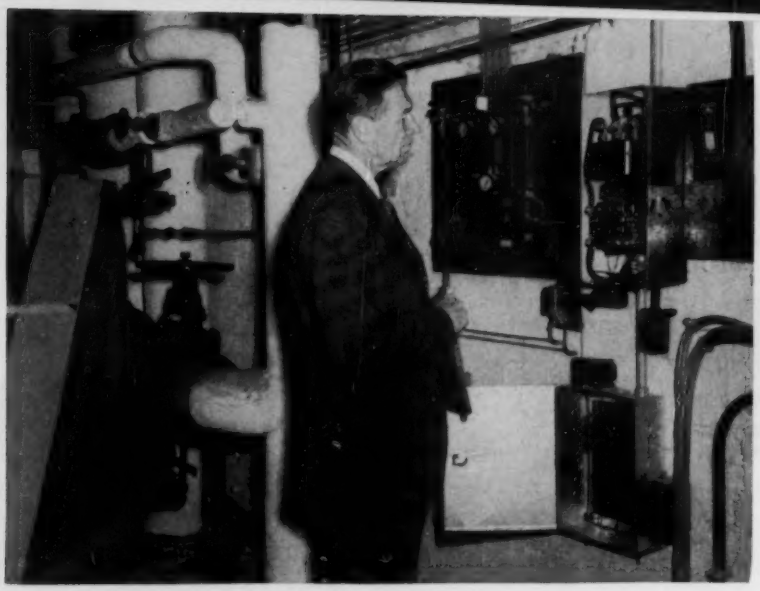
Power cost	$8221
Refrigeration room	$1200
Heating	$3500
Labor, 4 hours daily	$3216

The power savings are estimated to be the result of multiplying half of the total time required between the starting of the first and last fans on the route of each engineer by the kilowatt hours in each fan group. A power saving will also be accomplished in the refrigeration room; with fan operation time reduced, the period of centrifugal machine operation can also be reduced proportionately. In winter, smaller quantities of intake air will be used, with a saving in steam required.

There are 7000 tons of refrigeration and 230 fans.

To Finish Air Conditioning

When completed in 1930, the Mart had the largest ventilation installation that had been made up to that time. There was a total of 58 exhaust fans and 47 intake fans. Areas originally planned for warehouse spaces mainly had exhaust ventilation only. On most floors, air was furnished from 40,000 cfm fans at either end of the building. The distance from the fans to the last outlet was nearly 400 ft. All fans were controlled by uralite switches, and



THE LOW VOLTAGE CONTROL SYSTEM permits operation of all present ventilating fans and provides for the future fans that will be required when air conditioning of the building is completed

each fan was turned on and off at the fan location.

Originally, the only two tenant areas that were air conditioned were radio studios on the 19th and 20th floors and a large restaurant on the first floor. In 1937, when the decision was made to program air condition the entire building, it was necessary to install seven or more additional fans per floor to provide adequate air and to reduce the long duct runs, bringing the total up to 230. At present, all but 250,000 sq ft of the occupied space is air conditioned.

Fans Operate on 480 Valts

A low voltage control system was designed, with indicating pilot light, which permits operation of all present ventilating fans and provide for the future fans that will be required for complete air conditioning. All fans so controlled are operated on a 480 volt three phase system. It, of course, was necessary to change all of the original motor starters from the obsolete manual type to a conventional line voltage magnetic motor starter, including a 480 volt disconnect switch and a start-stop switch with a lock-out button.

The control panel is in the refrigeration room and is operated by the engineer on duty there. The panel is 62 in. high by 14 ft 2 in. long by 12 in. deep. It has eight 18 in. doors, each with a capacity of 30 start-stop and pilot light stations. Each start-stop starter has name plates which identify the number and location of unit. Also, each station is color coded for varying starting and stopping times as required.

Equipment in each fan room consists of a relay cabinet with a 480/24 volt high reactance control transformer for powering the relays and a transformer for the pilot lights.

Telephone cables of 22 gage in 5 to 46 conductors as required are installed between relay panels and the motor location in the master control station. All joints and splices are in conventional terminal type cabinets with terminal strips. Motor starters are capable of manual control from each fan room so that, in case of failure of any portion of the low voltage system, they can be started in the conventional manner.

Operation has been most satisfactory, and it is believed that little servicing will be required.

Shopping Center Sets Challenge For Air Conditioning

. . . great variation in requirements

MAGIC CITY, Barberton, Ohio, like many shopping centers, presented a challenge to air conditioning installers, reports the General Electric Co. This $3.5 million project of 36 stores, an underground bowling alley and several professional offices uses 450 tons of air conditioning.

Because the type of tenant for each store was unknown at the time of construction, the stores were built in various sizes and only side walls, partitions, and roofs were constructed. From the time each lease was signed, it was only two weeks until the concrete floors were poured, ceilings put in and the store completed.

A great variety of applications were necessary. Units are installed in-space, out-of-space, on the selling floor, in storage rooms, and in basements. Most stores called for only one or two packages to air condition them. However, one chain store required 70 tons of capacity.

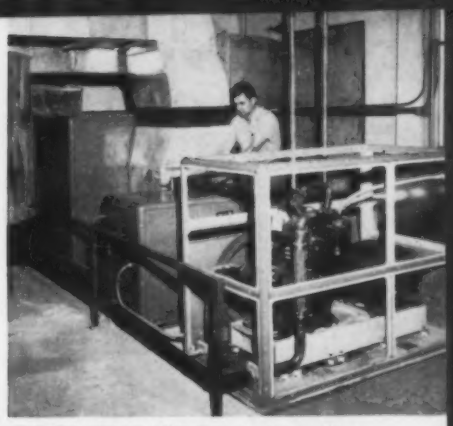
This store includes a mezzanine, main floor sales area and basement. Half of the basement is storage area and half sales floor. Air conditioning and heating of the basement is with one 15 ton unit and a heating coil. Because the basement is 140 ft long, ducts are used. These ducts were installed out of sight in the storage half of the area. During the cooling cycle only, the supply outlets facing the sales area are used, and the storage area outlets are closed. During the heating cycle, supply outlets in the storage area are also opened.

The first floor sales area of the chain store required 45 tons of air conditioning in three zones. Three units, each having 50 percent capacity modulation, are set in a mezzanine equipment room. Air distribution for the mezzanine area is through ceiling outlets. Heating is by hot water coils from a central boiler, the source of heat for all the units in the store.

Heating and cooling for each zone are regulated by a single control for each 15 hp unit.

How Much Does a Heat Pump System Cost?

Installation and operating costs of heat pump systems in a new courthouse and an all electric hospital substantiate the original choice of equipment for these installations



15 TON HEAT PUMP and air handling unit are among air conditioning equipment totalling 90 tons in the new courthouse at Cordele, Ga.

By W. D. Sinclair
Chief Engineer and Manager
Crisp County (Ga.) Power Commission

WHEN Crisp county, Ga., decided to build a new courthouse and office building, the power commission was assigned the job of heating the building electrically, since the county owns its own hydro-electric system.

Studies showed that using oil at 20c per gal in a steam heating system would cost $1.85 per million Btu, whereas electricity at 1c per kwhr would produce the same heat for $1.00 per million Btu.

The heating load of the new courthouse was calculated to be 973,000 Btu per hr, while the cooling load figured 1,200,000 Btu. The unbalanced condition between the heating and cooling loads is due to a large number of glass windows in the building.

Data showed that the heat pump would be flexible and could be adapted to four zones and would operate economically.

Install Heat Pump for $35,000

The heat pump was installed at a cost of $35,000, exclusive of the well, which cost approximately $3800. Thus, the total cost was less than $500 per ton for heating and air conditioning, including the well, pump and duct work installed.

The units are of the water to air type and consist of 10 ton, 15 ton, 25 ton, and 40 ton packaged units.

Operational tests show that the units have a coefficient of performance of 3.25 to 1 on the heating cycle. Approximately 150 gpm of water at 70 F is required for the heating cycle at full load. The water can be recirculated on the cooling cycle. Further analysis shows that the heating and cooling cost of 1c per kwhr is only $1.89 per hp per month.

Table 1 shows the power cost by months for one year, including heating and cooling on a 24 hr day operating basis.

Upkeep and maintenance costs have been less than $100 per year.

Based on the experience at the courthouse, Crisp county decided to apply the heat pump to a modern 50 bed Hill-Burton hospital, which it built and placed in operation three years later. This hospital is the only all electric hospital in the U. S., as far as we know.

TABLE 1—POWER COST for one year, including heating and cooling on a 24 hr day operating basis, is given here for the 90 ton heat pump installation in the Crisp county courthouse

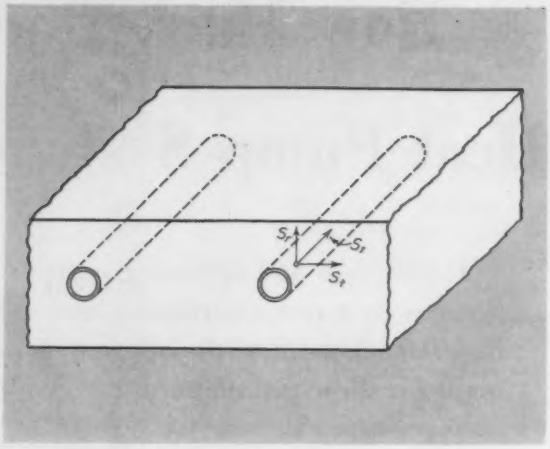
	Total Kwhr used	Total power cost	Heat pump power cost
October	10,800	$138.47	$ 96.93
November	19,800	228.38	159.87
December	18,680	217.19	152.03
January	31,160	341.87	239.31
February	20,240	232.77	162.94
March	16,600	196.41	137.49
April	18,120	216.59	148.11
May	18,920	195.01	136.51
June	17,080	178.67	125.07
July	35,080	338.51	236.96
August	29,240	286.65	200.66
September	37,760	362.31	253.62

Hospital Has 150 Ton System

The hospital is completely air conditioned the year 'round with a 150 ton heat pump installation. The system is a water to water to air type. Approximately 400 gpm of water is required at full load on the heating cycle. Outdoor air is passed through electrostatic and activated carbon filters for the four zones requiring 100 percent outdoor air. Intake for the remaining five zones which is recirculated is filtered through other filters.

$110 per Bed Lower

One year's operation shows that the cost of all utilities — water and electricity — is only $210 per bed per year, whereas the national average for hospitals, without air conditioning, is $320 per bed per year. This represents a saving of $110 per bed per year. Current cost averages about 1.0c per kwhr. The water to water to air system has been found less efficient than the water to air system installed in the courthouse.



1 THREE STRESSES developed by the heating of a concrete panel by a fluid in an embedded pipe are the radial s_r, tangential s_t, and longitudinal, or axial, s_z

Are Thermal Stresses a Problem

Although the length of pipe — or panel length — has absolutely no bearing on the stress in a snow melting or radiant heating slab, there are certain other factors that should be watched. Most important, the temperature difference between the circulating fluid and the slab surface should be kept to a minimum. For radiant heating, the normal operating temperatures are far too low to be troublesome. With snow melting systems, however, operating temperatures may develop thermal stresses that approach the danger point. Three ways to keep the temperature differences — hence thermal stresses — to a minimum are:

1) Keep pipe spacing down. Good practice is ¾ in. or 1 in. steel pipe on 12 in. centers.

2) If economically feasible, use a continuous operation. Even with intermittent operation, use a low limit control to prevent slab temperatures from getting unnecessarily low. Good practice is a low limit of −10 F.

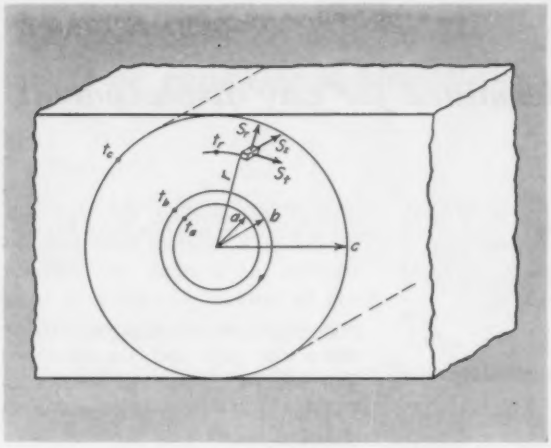
3) Use a good volume of flow so that entering and leaving temperatures are relatively close. Good practice is to use a temperature drop of about 20 F.

Second, and closely related to temperature difference, is depth of bury. A deep bury provides some extra strength, but may be offset by increasing temperature drop. Here, however, compromise is necessary to allow for field conditions and for external corrosion protection from surface moisture. Taking all things into consideration, a good cover coat seems to be about 2 in. top and bottom. This gives good protection, sufficient strength, and still adequate response.

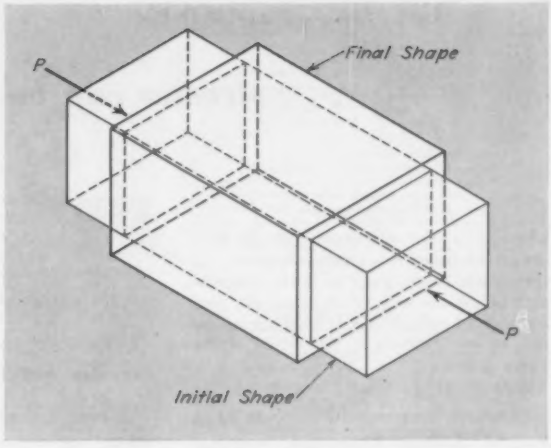
The stress most likely to cause failure is the tangential or hoop stress, and the failure will be a tensile failure in the concrete. Next is the axial stress, and least likely is the radial stress. An excessive hoop stress causes hairline cracks to appear on the top and bottom surfaces over the pipe and running parallel to the pipe. The cracks will progress and eventually extend clear through the concrete to the pipe surface.

If the indicated hoop stresses exceed 300 psi in tension, it is good practice to install some reinforcing steel above the pipe. The reinforcing steel should be designed to carry the difference between the indicated stress and the allowable stress, say 300 psi.

When high structural loads are anticipated — for example, roadbeds, loading ramps, and such — reinforcing steel should be used above and below the pipe.



2 THE THERMAL STRESSES s_r, s_t, and s_z virtually end at the distance c. Temperatures t_1 and t_2 would be found at corresponding radii r_1 and r_2, respectively



3 LATERAL DISPLACEMENT of an elastic material due to a compressive axial force is the resultant of the interacting radial, tangential, and axial stresses when the body is under thermal stress

in Snow Melting Systems?

By William P. Chapman

Engineering Sales Service Representative
National Tube Div., U. S. Steel Co.

—Yes, but they can be avoided by keeping the temperature difference between the fluid and the slab surface to a minimum, by providing a 2 in. pipe bury in the concrete, and by installing reinforcing steel above and below the piping where high structural loads are anticipated

SNOW MELTING, unlike radiant heating, can develop excessive thermal stresses. They can be avoided, it has been found, if proper design precautions are taken.

Actually, this study was begun to look for the answer to a question often asked, *How long a pipe can be embedded in concrete?* However, it was soon learned that length makes no difference. With each step of the analysis becoming more intense, the scope was enlarged to include other practical aspects of thermal stresses.

Three Stresses Developed

Three stresses are developed by the heating of a concrete panel — radial, tangential, and longitudinal. See Fig. 1. In this analysis, it is assumed that the stresses are sufficiently dampened at distance c from the center — see Fig. 2 — so that essentially there is no strain beyond that point. In other words, the concrete outside the inscribed circle c adds negligible strength to the system.

What happens when a hot fluid is pumped through the embedded pipe? If the thermal back loss is 50 percent, then the temperature gradient will be concentric about the longitudinal axis of the pipe. Also, there will be a decrease in the slab temperatures, such that:

. . . stresses can be determined for any displacement,

$$t_a > t_b > t_r > t_c$$

where t_a = the temperature of the fluid inside the pipe; t_b = the temperature of the outside of the pipe; t_r = the temperature of the concrete surrounding the pipe for a given radius; and t_c = the temperature of the concrete at the extent of the stress system.

Then, if rings where cut from the slab, each ring would expand to a radius greater than the original radius. In each ring, though, the expansion would be different because of the different temperature.

These rings could be expanded in three ways. In each case, the expansion would be identical to the thermal expansion, and would be accomplished by applying a stress. First, let us take a ring of radius r_1. Heat it from t_1 to t_2 so that the radius is now r_2 — see Fig. 2. Such an increase could be obtained if the ring were cut, flattened out, stretched and put back into shape. This would be equivalent to a tangential or hoop stress. The magnitude of the stress can be calculated by means of Hooke's Law.

$$s/e = E \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

where s = stress; e = strain; and E = modulus of elasticity

which would be for this example

$$s_t = e_t E \quad \ldots\ldots\ldots\ldots\ldots\ldots [2]$$

where s_t = tangential stress; and e_t = tangential strain.

A second way of expanding this fictional ring would be to apply a hydrostatic pressure, p, against the inside diameter of the pipe. This would balloon the entire slab until our ring changed the radius from r_1 to r_2 as desired. This stress is the radial stress s_r.

The third way, a little more difficult to see, is illustrated in Fig. 3. If a body is subjected to a compressive force on the y axis, it will be reduced in length on that axis. If it is an elastic material, this shortening in the y direction will be made up by an increase in the x and z directions. The ratio of the x and z changes with respect to the y change is called Poisson's ratio, N. We can say, therefore, that by applying a compressive axial stress, s_z, we could get the expansion of r_1 to r_2.

Stresses Act Simultaneously

When a body is under thermal stress, all three stresses — radial, tangential, and longitudinal — s_r, s_t, and s_z, are acting simultaneously. Therefore, there is an interaction of all three stresses. This means that the stretch due to the hydrostatic pressure cannot be considered without considering the effect of tangential and longitudinal stresses as well. Thus, there are three simultaneous equations:

$$e_r = [s_r - N\,(s_t + s_z)]/E \quad \ldots [3]$$

$$e_t = [s_t - N\,(s_r + s_z)]/E \quad \ldots [4]$$

$$e_z = [s_z - N\,(s_r + s_t)]/E \quad \ldots [5]$$

where e_r = radial strain; e_z = axial strain; and other symbols are as previously defined.

Briefly, in review, pumping a hot fluid through an embedded pipe causes temperature changes in the pipe and in the concrete. This heating causes the concrete to expand radially, tangentially, and longitudinally. The magnitude of these stresses can be determined for any given displacement. Also, since these stresses are interacting, they must be considered simultaneously.

What Pipe Length Is Safe?

If the coefficient of thermal expansion of the pipe is different from that of the concrete, the pipe will expand at a different rate than the concrete. As a result, the concrete will be stressed in tension or compression at the common surface between the pipe and the concrete. This will set up induced stresses in addition to the thermal stresses mentioned above.

It is these induced stresses that often cause the question, *What is the maximum length of pipe that can be embedded safely in a concrete slab?*

The pipe wants to expand — longitudinally — further than the concrete, and thereby pull the concrete apart. Such a force may exist; it would be one of the induced stresses. The other induced stresses are due to similar actions in the radial and tangential directions.

It often happens, however, that the pipe tends to expand less than the concrete. Then the induced stress would tend to pull the pipe apart. In either case, the difference in expansion induces stresses.

As in the case of pure thermal stresses, the interaction of s_r, s_t and s_z must be considered because Poisson's ratio will be just as evident with the induced stresses as with the thermal stresses. Hereafter, the stresses s_r, s_t and s_z represent combined induced and thermal stresses.

Obviously the "drag" of the slab on the fill will be present; its effect, however, should be slight. It will be noticed primarily as an axial stress on the slab and will be of little consequence.

TABLE 1—PHYSICAL PROPERTIES of pipe and concrete used in this study are given here. They are averages of values from several handbooks

Material	Coef. of Thermal Expansion, linear	Ultimate Strength, psi		Poisson's Ratio	Modulus of Elasticity, psi
	A	Tensile	Compressive	N	E
Aluminum[1]	12.3×10^{-6}	15000	15000	0.33	10×10^6
Concrete	$(6.0$ to $7.0 \times 10^{-6})$[2]	300	3000	0.15	3×10^6
Copper[1]	9.3×10^{-6}	35000	35000	0.35	15×10^6
Steel[1]	6.5×10^{-6}	45000	45000	0.30	30×10^6
Wrought Iron[1]	6.7×10^{-6}	40000	40000	0.30	27×10^6

[1]Based on properties of tubular grades.
[2]Values of $A_c = 6.0 \times 10^{-6}$, 6.5×10^{-6}, and 7.0×10^{-6} were used to determine the effect of various rates of expansion. For all other cases, $A_c = 7.0 \times 10^{-6}$ was used.

must be considered simultaneously

The physical properties assumed for the pipe and concrete are listed in Table 1.

Set Four Boundary Conditions

The approach to the problem was to set up four boundary conditions such that

1) The radial stress in the pipe at radius a is zero. See Fig. 2.

2) The radial stress in the pipe at radius b is equal to a hydrostatic pressure, p.

3) The radial stress in the concrete at radius b is also equal to p.

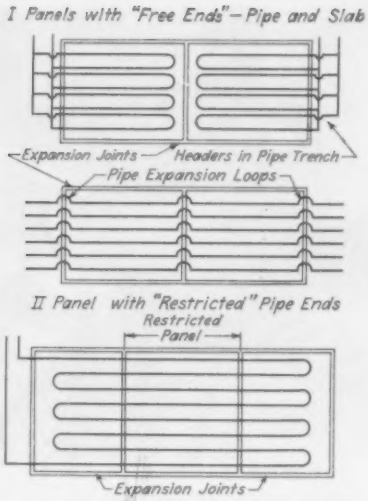
4) The radial stress in the concrete at radius c is zero.

In the special case of a homogeneous cylinder — for example, a hollow concrete cylinder — conditions 2 and 3 are omitted.

By superimposing the stresses of the concrete cylinder on the stresses of the pipe, and vice versa, it was possible to determine the equivalent hydrostatic pressure, p. This then permitted the evaluation of conditions 2 and 3 and the complete analysis.

The only difference between the stresses in a homogeneous and composite cylinder would be due to the temperature difference $t_a - t_c$. For the composite cylinder, the temperature difference through the concrete is $t_b - t_c$; whereas, for the homogeneous cylinder it is the full $t_a - t_c$.

At $r = c$ then, there is the unique condition that both the radial and axial stresses are independent of the induced stresses set up by the pipe. From that, it may be inferred that at the outer fibers of the concrete the induced stresses set up by the pipe affect only the tangential stresses.



4 DIFFERENT TYPES OF PANELS shown here produce little practical difference in stresses

Due to the complexity of the problem, space limitations do not permit the presentation of the complete derviation of the equations used. The author will be glad to provide the derivation to anyone writing him in care of the Editor.

In an early future issue the author will explain why the pipe length can be ignored, why the tangential stress is the worst, why a 2 in. bury seems best, and will discuss the linear effect of temperature drop, the interrelationships of the independent variables, and how pipe diameter affects temperature.

Construction Contracts Soar, Shatter Previous Records

. . . no surpluses yet

CONTRACT AWARDS for future construction in the 37 eastern states — according to the latest figures — shattered many previous records in April, reports the F. W. Dodge Corp. The record breaking total of $2,322,085,000 was 37 percent higher than April 1954. It was the highest April on record and the highest for any month, except May 1951, when nearly $1 billion of atomic energy contracts fattened the total.

Also, the first four months of 1955 topped any first four months in history. All three major categories — residential, non-residential, and heavy engineering — set new records for April and for the first four months.

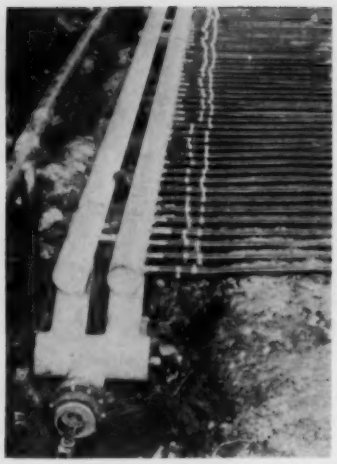
Commenting on the new figures, Thomas S. Holden, Dodge vice chairman, said, "Continuously rising contract volume is perfectly normal for this strong economy which is expanding so rapidly on many fronts; economic growth urgently demands new structural facilities in all existing categories, and also an ever-widening range of new structural types and of structures built to improved architectural and engineering standards.

"Although this is the 11th consecutive year of mounting construction volume, there is yet no sign that significant surpluses have been produced. . . . While the construction outlook from this point is excellent, there is, of course, no assurance that future advances will maintain the current high rate."

The April total construction figure also was 9 percent above March this year.

Individual April classifications were: nonresidential, up 17 percent over April 1954 but down 7 percent from March at $706,019,000; residential, up 34 percent over April 1954 and up 8 percent over March at $1,070,129,000; heavy engineering, up 88 percent over April 1954 and up 41 percent over March at $545,937,000.

The four month 1955 total construction figure was 35 percent above the comparable 1954 period at $7,542,497,000.



AT HOUSTON MEETING —

Contractors See More Use of Plastic Pipe and Fittings

Dimensional standards, distribution through regular piping channels held important . . . . many applications — also some limitations — discussed

INTERCHANGEABILITY of plastic pipe and fittings with those made of metal is essential to the use of this new piping material. Dimensional standards for pipe and fittings made of the various plastics are of "first importance," according to a resolution passed unanimously at the plastic pipe panel session held during the 66th annual convention of the Heating, Piping and Air Conditioning Contractors National Association (now the Mechanical Contractors Association of America, a new name adopted at the meeting) in Houston last month. Such standards should include tolerances, marking, and tests, it was recommended.

Piping contractors should give careful attention now to the channels through which plastic pipe and fittings are sold, it was recommended also, for "we want to buy them from the regular channels of distribution who know the piping field," as one contractor put it.

Keep Up-to-Date on Plastics

The panel discussion was sponsored by the association's recently appointed plastic pipe committee — M. W. Eddins, chairman, Stanley B. Bellis, William J. Olvany, and F. E. Wendel. Its objective is to gather information to keep heating, piping and air conditioning contractors up-to-date on plastic pipe and fittings. "A tremendous increase" in their use during the next five to 10 years is expected, according to Mr. Eddins, who presided.

Terminology should be simplified, too, said one contractor. "How are you going to put one of those long chemical names on a stock bin?" he asked.

Standardization under procedures of the American Standards Association of plastic pipe and fittings was the subject of a meeting held early last month in New York City, Mr. Olvany reported. He represented the heating, piping and air conditioning contractors — the group also included representatives of the heating and air conditioning engineers, refrigerating engineers, the chemical industry, and the plastics industry, he said.

Proper Applications Suggested

Many piping applications for plastics and suggestions for their use were given by the contractors attending the Houston session. Plastic piping is often used because of lower first cost, but this is by no means always the case, said Joseph H. Spitzley, as plastic pipe "is not necessarily cheap, particularly in the larger sizes."

He said that plastic pipe and plastic lined pipe has been used for some eight years on plating installations in automobile plants, being chosen for its resistance to the solutions employed. The contractor is often called upon to re-pipe such jobs when the solutions used in the process are changed, he mentioned.

On a certain chemical piping job, also mentioned at the meeting, plastic pipe "lasts indefinitely," whereas the thin wall alloy pipe formerly used developed small pinholes in 10 days to two weeks, requiring regular replacement.

Another contractor, John F. Kelly, reported the use of plastic piping for nitric acid, for a similar reason. He said there had been trouble on this extensive job in threading the plastic pipe — which was done, he stated,

in the same way as steel pipe is threaded — as the strain tended to break the threads off. The application was justified, however, despite the need to replace the damaged joints, he said.

There are many applications for plastic materials in the fabrication of ductwork, it was pointed out.

In addition to process uses, other plastic piping applications include drop pipes in wells ("very practical because of the light weight"), brine piping for skating rinks and other purposes, and radiant heating ("quite suitable because of the range of pressures and temperatures involved.") Use of 1¼ in. plastic pipe for cooling tower lines was also mentioned, although two contractors reported trouble on such jobs with horizontal splits in the pipe. (It should be remembered that there are many plastics, with many different properties.) Small, close connections with a lot of offsets and bends are a handy application, it was mentioned.

Plastic Used for Radiant Panel

R. C. Denkmann described briefly a 6000 sq ft floor slab radiant heating system he had installed about three years ago, using polyethylene pipe, which he said has given good service — although he understood that the pipe manufacturer had since discontinued his recommendation to use his pipe for that purpose. The maximum design water temperature was 120 F, and the ¾ in. ID pipe is on 12 in. centers. The longest circuit is 500 ft. The only joints are at the metal pipe headers, stainless steel hose clamps being used.

There were two pours of concrete. The first was 3 in. and then the pipe was clipped to it with straps and roofing nails. The second 3 in. pour completed the 6 in. slab.

The job has but one zone. "Complete cost was 65c a square foot," he stated, which was "less than it would have been with metal pipe." Because of the lower heat transfer rate of plastic as compared to metal, about 10 or 15 percent more plastic pipe surface is required on a radiant heating job, he believes.

Avoid Mis-Applications

Suggestions on avoiding mis-applications of plastic pipe and fittings were given at the meeting. Until dimensional standards are developed and universally used, the contractor should assure himself that the pipe and fittings he buys are of the right dimensions to avoid mis-fits with each other and with metal pipe (when plastics and metals are to be used in the same system).

Temperatures and pressures must be watched, and the proper plastic material for the application must be selected (there are so many different plastics that it is somewhat misleading to refer to all of them by any one term).

Some plastics will contaminate potable water, it was stated. Regulations in one city allow the use of polyethylene pipe on underground water lines, if the line is on private property and if there is a check valve to prevent hot water entering the plastic pipe, it was stated.

The coefficient of expansion varies greatly, and must be watched carefully in piping work, it was suggested. In some cases, "it may be three times that of carbon steel." One contractor reported a job of his where plastic adaptors were used in an air conditioning system to insulate steel and copper piping from each other to prevent electrolytic corrosion. Both chilled and hot water is circulated through this piping, depending on the need for space cooling or heating. He said the plastic fittings apparently expanded at the 160 F temperature and "failed to come back" when cooled. These adaptors "leaked like sieves" and had to be replaced, he said.

Fitters should be cautioned not to tighten clamps to the extent that fittings are cracked, a contractor suggested.

How To Join Plastic Pipe

Mr. Eddins, in concluding the session, mentioned other types of joints for plastic piping which had not been referred to during the discussion. Piping connections may be made by using a solvent ("solvent joints"); by welding with hot air (heating the air electrically or by a gas flame, but not — however — applying the flame to the weld); and also by putting plastic rod in an electric drill, using friction to create heat for welding.

He listed three books which, while they do not apply specifically to plastic piping, are sources of information on plastics:

Plastics in Building, published by the Building Research Institute, National Academy of Sciences, National Research Council, 2101 Constitution Ave., Washington 25, D. C. $5.00.

Manual for Plastic Welding, published by the Industrial Publishing Co., 1240 Ontario St., Cleveland 13. $6.00.

Plastic Engineering Handbook, published by the Reinhold Publishing Co., 430 Park Ave., New York City. $15.00.

The well-attended session (about 50 contractors were in the audience), the lively discussion and the numerous questions indicated the great interest of those who install industrial process, heating, air conditioning and other piping in the new plastic materials.

FTC Calls Meeting To Define Air Conditioning

At a discussion of suggested trade practice rules prepared by the Refrigeration and Air Conditioning Contractors Association at a conference called by the Federal Trade Commission and held in Chicago on May 20, it became obvious that it will be essential to define what the "air conditioning industry" encompasses.

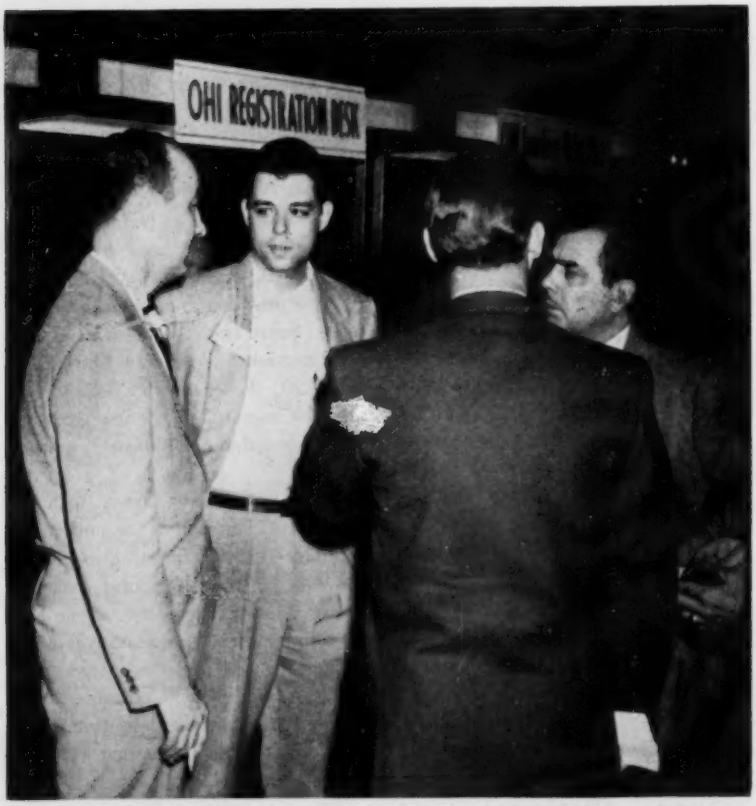
Paul Butts, an attorney with the FTC, and chairman of the conference, therefore called a meeting to be held in Washington, Wednesday, June 22, at 10 a.m., in Room 286 of the FTC building, when representatives of associations and societies interested in air conditioning will be asked to aid in preparing such a definition.

Need for a definition that will make clear that air conditioning includes heating, ventilation, humidifying, air cleanliness, etc., as well as cooling, was stressed at the Chicago session.

HOW EFFICIENT ARE

Methods of

COMMERCIAL - INDUSTRIAL PANEL at the 33rd annual convention of the Oil-Heat Institute of America, Inc., in Chicago was led by Technical Secretary C. H. Pesterfield



DISCUSSION GROUPS, informal as well as formal, gave evidence of the importance and interest of the Institute sessions, highlights of which are given in this article

THE NATURE of today's heavier fuel oils means that we can't burn them as we did the oils of 20 years ago, said R. Lisson, of Davis Engineering Corp., at the commercial-industrial panel session held during the Oil-Heat Institute's convention in Chicago. Today's oils require careful analysis of their preheating requirements. This is a local installation problem, for the heavy oil in one area may be quite different from that distributed only 50 miles away.

Ignition methods used today are a far cry from the kerosene-soaked rag wrapped around a rod, which was all that was needed to start the manually ignited heavy oil burners of that period. The change to the present day ignition and control systems stems from the development of the fully automatic heavy oil burner, he said.

Term "Viscosity" Proposed

William Bohn, of Preferred Utilities Mfg. Corp., had a few words to say about preheating and oil viscosity at the same session. He suggested that the words "No. 5 oil," "No. 6 oil" and "bunker C oil" be omitted from the user's vocabulary and that the viscosity of the oil be used instead. If manufacturers of oil firing and accessory equipment know the viscosity of an oil, they can advise engineers and contractors on the proper equipment to burn it.

If an oil preheating system can deliver fuel to the oil burner hinge at the equivalent of 450 SSU viscosity, good results will be had, he said. Because of week-end and other shutdowns, and spring and fall operation, schools and apartment buildings present problems in maintaining

Burning Heavy Oils?

. . . . It all depends on such factors as better coordinated understanding of oil characteristics and specifications, proper choice of the boiler and other equipment, and tip-top preventive maintenance from the drawing board to the actual program

proper oil viscosities. In such cases, he recommended considering auxiliary electric preheating of the oil. The cost of auxiliary preheat might run $250 to $300, he believed.

Need to Clarify Specifications

Continuing the discussion of fuel oil characteristics, W. A. Sullivan, of the Shell Oil Co., said he felt there was need to clarify what "fuel oil specifications" are, because of the wide variations in oils. The three types of specifications, he said, are:

1) General sales specifications, such as the Commercial Standards, which allow broad tolerances.

2) Manufacturing specifications, which are more exact and are instructions from the marketing department of an oil company to its refinery — the intent being to provide a superior fuel.

3) Special purpose specifications, for specific applications, which are based on a thorough study of a particular use. Such specifications shouldn't call for characteristics that aren't really needed, he warned.

It was announced that the American Society for Testing Materials (ASTM) specifications on fuel oils are due for review next year.

Good Maintenance Is Essential

Preventive maintenance of oil burning installations "starts on the consulting engineer's drawing board in the choice of equipment," said Anthony Jelenc, of Ace Engineering Co. The purpose of preventive maintenance is to "reduce service calls, avoid emergency shutdowns, prolong equipment life and maintain its efficiency." The installer of oil burning equipment should supply two instruction manuals for each job, one for the operator and one for the plant or building management, he said.

Cleanliness of the boiler room is most important to good maintenance, he stated. He listed specific maintenance suggestions:

1) Maintain all bearing lubrication. Don't over-lubricate.

2) Keep atomizing cups clean. Otherwise, atomization will be poor.

3) Keep air ports clean.

4) Have spare clean electrodes on hand. Electrodes are a prime cause of service calls.

5) Replace electronic tubes yearly.

6) Clean boiler tubes regularly, the frequency depending on the type of oil and the type of boiler operation.

7) Repair refractory to keep it in good condition.

8) Be sure low water cut-outs are in good operating order.

9) Check oil strainers periodically.

10) Check oil storage tanks yearly, and clean them probably every three or four years.

"Choose Right Package Boiler"

Packaged boiler units "are here to stay," said Mr. Bohn, in his comments on this equipment, with some two dozen different makes on the market. They represent "tremendous differences in design — two-, three- and four-pass, updraft and downdraft, forced or induced draft, varying firing methods, and heat releases from 100,000 to 250,000 Btu per cu ft." Each is designed to meet a particular market condition, and each must be assessed in relation to the job's requirements, he said. For good efficiencies, there must be some method of draft control.

During the question and answer period, he was asked if less heating surface in a packaged boiler shortens its life. "If the design improves the heat transfer, it shouldn't shorten the unit's life," he replied.

He was asked also about standardization of package boiler ratings. He said that some of the manufacturers had made efforts along these lines, but due to lack of agreement, the matter had been dropped now.

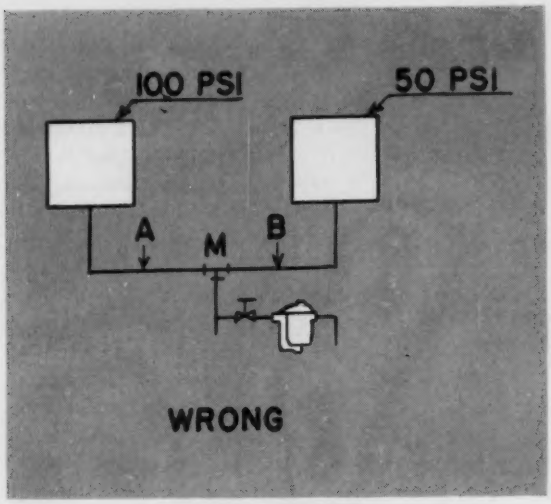
Mr. Bohn was asked if he recommended multiple burners on a single suction line. He said in reply that the only reason for such an installation was a lower installation cost. The disadvantages of such a job are that a worn pump may be robbed of oil by a newer pump; also, a bigger burner will rob a smaller one.

Require Installation Approval

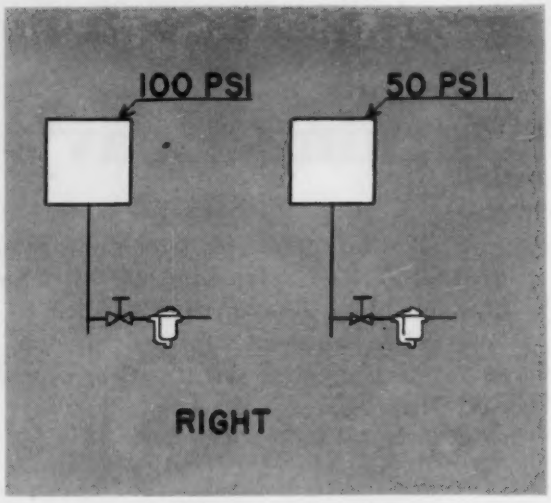
George Woods, of the Factory Insurance Association, spoke briefly on the methods by which insurance companies approve oil burning installations. He said they insist on approving and field testing all new installations in regard to the safety controls.

Carl Swanson, of Minneapolis-Honeywell Regulator Co., (who spoke during the morning session) also served on the afternoon panel. He was asked if controls are being standardized for various purposes, but indicated that codes limit such standardization. He stated also, in reply to another question, that the varying requirements of different applications prevented standardization of a control for all oil burners.

Charles H. Pesterfield, professor of mechanical engineering at Michigan State university, served as moderator for the panel session.



1 SHORT CIRCUITING of steam and condensate from the 100 psig heater past the tee to the 50 psig heater is inevitable with this single trap arrangement



2 SEPARATE TRAPS for heaters with unequal pressures affords proper drainage and avoids backflow or short circuiting

Preventing Steam Short Circuiting

Short circuiting of backflow in steam pipes or steam condensing units can be avoided by insuring proper drainage. Here is an analysis of the cause and the cure by the proper use of steam traps.

By T. H. Rea
Armstrong Machine Works

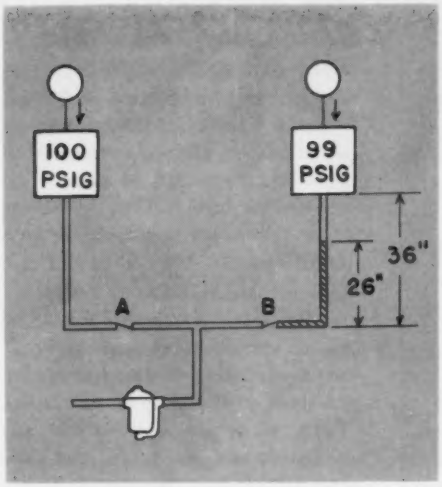
THE ELECTRICAL TERM "short circuiting" as adopted by steam trappers describes poor drainage of two or more steam pipes or steam condensing units when using a single steam trap. Why does short circuiting of steam drainage systems occur? What can be done to prevent it?

While this discussion is centered around unit heaters, short circuiting applies equally well to jacketed kettles, garment presses, platen presses, and pipe coils.

Must Use Separate Traps

No engineer in his right mind would attempt to drain a 100 psig unit heater and a 50 psig unit heater with a single trap, as shown in Fig. 1. Steam and condensate from the 100 psig heater would blow right past the tee, M, leading to the trap and on into the 50 psig heater. Condensate and a lot of steam from the high pressure heater would be dumped into the lower pressure heater. The trap would serve no use.

Installation of check valves at points A and B will not give good drainage. True, check valve B will close to prevent 100 psig steam from blowing through to the 50 psig heater. And condensate from the 100 psig unit will be discharged through



3 PRESSURE DIFFERENCE of 1 psig is enough to maintain water seal over check valve B, preventing escape of air and CO_2

Keep These Facts in Mind

1) One trap cannot drain two or more drip points with unequal pressures because steam will flow from the higher pressure point to the lower pressure point and block off escape of condensate and air. Differences in steam consumption of 1 lb per hr can cause short circuiting.

2) Installation of check valves does prevent backflow, but the check valve will remain closed until the pressures are equalized. The water seal above the check valve prevents escape of noncondensable gases.

3) Two identical units supplied with steam from a common header may have differences in terminal pressures due to unequal condensing rates caused by differences in temperature or velocity.

4) The only way to prevent short circuiting is to put a separate trap on each drip point so there will be a positive flow of condensate and noncondensables to the trap.

the trap. But, check valve B will never open to pass condensate from the 50 psig heater. The only way to drain the two heaters is to use separate traps, as shown in Fig. 2.

Instead of 100 psig and 50 psig unit heaters, suppose the heater steam supply pressures were 100 and 99 psig, respectively. Could a single trap drain both heaters if check valves were used? The arrangement with check valves in both drain lines is shown in Fig. 3. Check valve B will remain closed until the static head of condensate above it is 26 in. or 1 lb, which is the pressure difference.

As soon as the static head of condensate in line B exceeds 26 in., the check valve will open to pass some condensate. But there will always be a water seal over the check valve, and the water seal will prevent the escape of air, carbon dioxide or other noncondensable gases. These gases will accumulate with two adverse effects:

1) Reduce heat transfer rate. In fact, if the air is not vented, there will be no heat transfer.

2) Accumulations of CO_2 gas will produce acid condensate that will eat out the heater tubes.

Even if one heater operated at 100 psig and the other at 99.9 psig, there still would be a difference of 0.1 psig between the heaters, and the height of the water seal would be 2.6 in., which is enough to keep air and CO_2 in the heater with the lower pressure. The adverse effects mentioned before would still prevail.

Equal Lines Need Own Traps

Now, it is extremely unlikely that the two heaters would have separate steam supply lines with pressure differentials of only 0.1 psig. But will pressures in heaters with exactly equal supply lines from a common supply header be equal? Can a single trap be used?

One of the unit heaters may be nearer an outside wall, an open door, or some other supply of cooler air. It is not too much of a strain on the imagination to assume that heater A may be getting air at 60 F and heater B air at 50 F.

To simplify our explanation, let's assume individual traps on each heater as shown in Fig. 4b, for determining condensing rates and pressure drops. Then, we can see what would happen if the two heaters were joined together and drained with a single trap.

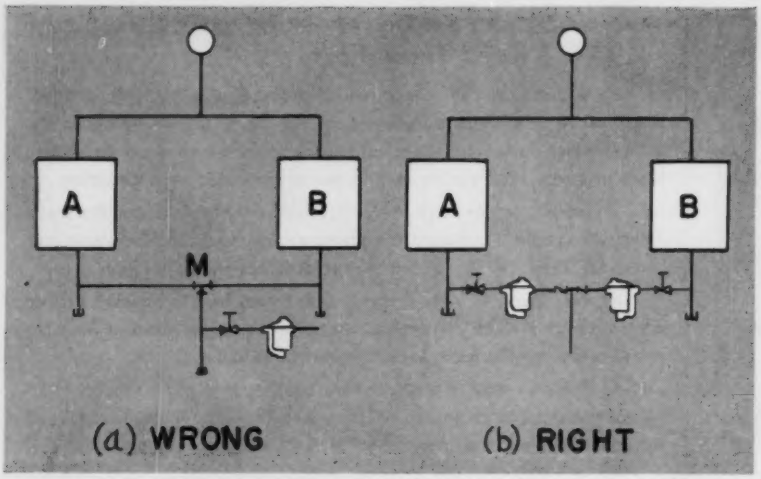
Now, from the table of constants for determining the Btu output of a unit heater with conditions other than standard, we find that the Btu output and steam consumption of a given size of unit heater at 50 F and at 60 F entering air temperature are in the ratio of 1.836 to 1.749. So, if we condense 1000 lb of steam at heater A, the steam consumption of heater B is obtained from the ratio of 1000: 1.749 = X:1.836. In this case, X is found to be 1050 lb of steam per hr.

TABLE 1—STEAM CONDENSING AND PRESSURE DROP DATA for heaters with single traps and heaters with separate traps is shown here

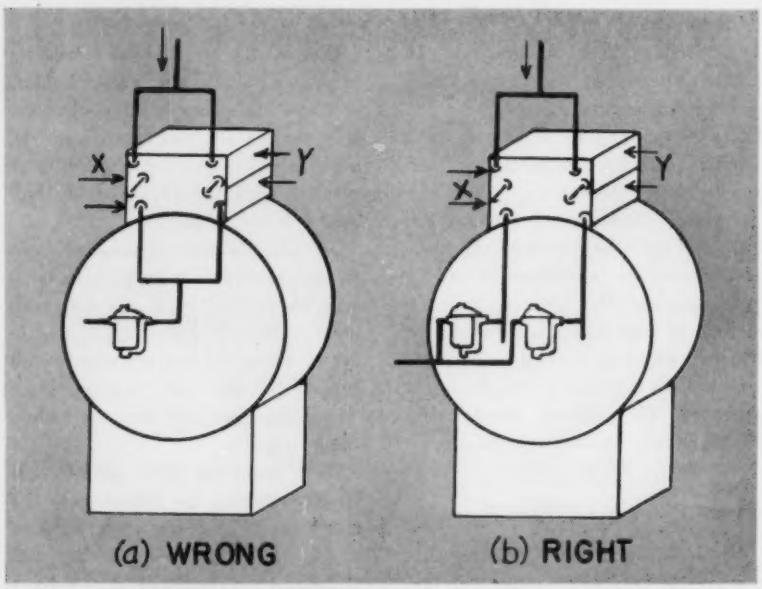
	Heaters with single trap	Heaters with separate traps
1—Equivalent length of supply pipe	10′	10′
2—Pipe diameter	1¼″	1¼″
3—Entering air temperature	60 F	50 F
4—Condensing rates at 60 F entering air	1000	
5—Condensing rates at 50 F entering air		1050
6—Pressure drop to heater	1.03	1.13
7—Terminal pressure at trap	98.97	98.87

Steam Condensing Rates

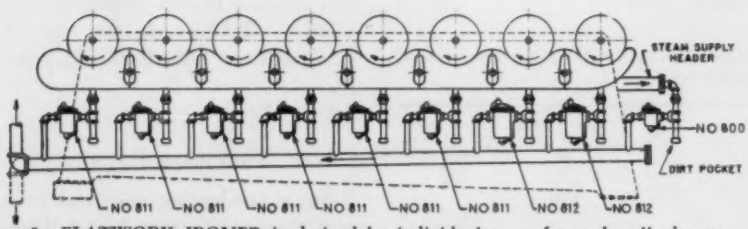
Steam condensing rates and pressure drops of heaters A and B are shown in Table 1.



4 UNEQUAL PRESSURE DROPS between heaters with equal supply lines, due to differences in condensing rates, necessitates separate traps (b) to insure proper drainage and prevent backflow



5 OPEN END DRYING TUMBLERS with separate traps on each coil (b) achieve greater output than with a single trap (a), due to unequal condensing rates of the coils



6 FLATWORK IRONER is drained by individual traps for each roll, due to widely varying loads, condensing rates, and pressure drops

If we took off the individual traps and joined pipes Nos. 1 and 2, as shown in Fig. 4a, would heater A condense 1000 lb of steam per hr and heater B condense 1050 lb of steam per hr? No. Both heaters would condense equal amounts of steam. The capacity of heater B would be reduced to that of heater A, or only 1000 lb per hr. Why?

At tee M, Fig. 4a, we could not possibly have a pressure of 98.97 psig on one side of the tee and 98.87 psig on the other side of the tee. The pressures actually would be equal. Heater A, exposed to warmer air, condenses less steam; therefore, its terminal pressure is slightly higher than the terminal pressure of heater B. Some steam from the common return line would flow past the trap take-off tee and enter heater B. As long as steam enters heater B from the return line, no air or CO_2 can escape from heater B. The backflow will continue until the amount of steam condensed by heater B equals that of heater A. When this condition is obtained, the pressure drops will be equal and heater B will be drained, after a fashion. However, air and CO_2 will reduce its heat output and, of course, the presence of CO_2 creates a corrosion hazard.

Steam Velocity Locks Air, CO_2

Let's look at short circuiting from the standpoint of steam velocity. A difference of 10 F in the entering air temperature causes a difference of 50 lb per hr in the condensing rate. If this seems too great a difference in air temperature, take a 2 F temperature difference. If 10 F makes a difference of 50 lb per hr, then 2 F would make a difference of 10 lb per hr.

What is the velocity of the steam past the tee M in Fig. 4b? The amount of steam flowing per hour past this point will be 5 lb per hr, or half of the extra steam that should be condensed by heater B. How important is 5 lb of steam per hr? At 100 psig, 5 lb of steam would occupy 19.45 cu ft of space, and 19.45 cu ft of steam will fill 1872 lineal feet of 1¼ in. pipe. Dividing by

3600, or the number of seconds in an hour, yields a velocity of 0.52 fps past the tee leading to the trap. This velocity is certainly high enough to prevent any escape of air from heater B as long as steam is flowing at this rate. If the temperature of the entering air were 10 F instead of 2 F, the steam velocity past the trap tee would be 2.6 fps.

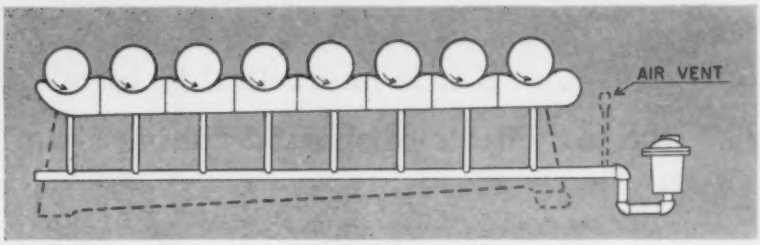
Any air in heater B is not going to get to tee M against steam flowing at a rate of 0.52 fps. True, condensate could flow by gravity countercurrent to the steam, but not so with the air or CO_2. Air and CO_2 will accumulate in heater B and reduce the heat transfer rate. When the amount of steam condensed in heater B is equal to that condensed in heater A, then there will be no flow of steam past tee M, and we get drainage from both units.

Thus, with two heaters and one trap, both heaters will condense equal amounts of steam even though one heater is capable of condensing more steam. Short circuiting equalizes heat output, not to an average, but to the level of the unit that condenses the least steam. The obvious remedy in this and similar cases is to use a trap on each unit.

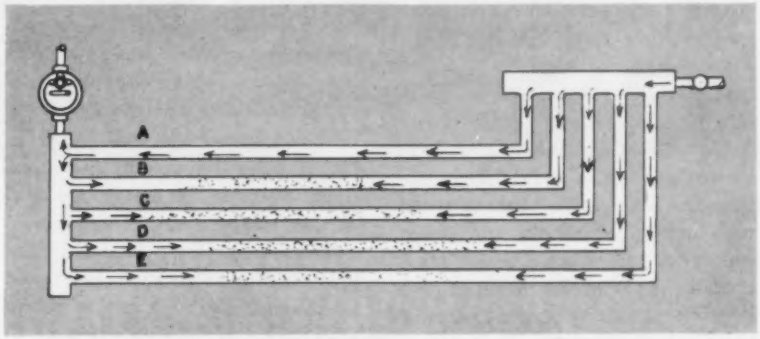
All three short circuiting examples are identical in that they involve a flow of steam from a higher terminal pressure unit past the tee M to a unit, or units, with a lower terminal pressure. The terminal pressures are, of course, the terminal pressures that would exist if each unit were perfectly drained; that is, free from condensate and air.

Differences in terminal pressures are caused by differences in condensing rates, or differences in pipe friction, or a combination of both. Where pipe friction is substantially equal in two pipes, a difference in condensing rates of 10 lb per hr would produce a velocity of 0.52 fps in the 1¼ in. line past the drain tee M to block the escape of air and thus cause short circuiting.

In the attempt to drain a 100 psig unit heater and a 50 psig unit heater, the great difference in condensing rates produced high velocity past the drain tee M.



7 GROUP TRAPPING would result in steam backflow from the return header to chests with lower pressures, thus accumulating noncondensables and reducing heat transfer rate and steam consumption



8 OLD STYLE HEADER COIL renders installation of individual traps impractical since steam from one pipe upon reaching the drain header first is not prevented from entering any of the other pipes

Reason for Short Circuiting

So, we arrive at the fundamental reason for short circuiting. There will be short circuiting whenever the velocity of steam past the drain tee M is high enough to keep air and/or condensate in the unit that should, when properly drained, have the lower terminal pressure.

This velocity of steam past drain tee M depends on three factors:

(1) Amount of steam passing to lower pressure unit, lb per hr;

(2) Weight of steam per cu ft;

(3) Internal diameter of pipe.

For 1 lb per hr flowing past tee M, this expression can be used:

$$\frac{CL}{T}$$

where C = cu ft per lb; L = lineal ft to hold 1 cu ft; and T = 3600 sec per hr.

In a ½ in. pipe at 10.3 psig, this figures out to 2.14 fps.

1 lb of steam at 10.3 psig = 16.3 cu ft.

½ in. Schedule 40 pipe requires 473.9 lineal ft per cu ft.

$$16.3 \times 473.9/3600 = 2.14 \text{ fps}$$

Table 2 is based on the above expression.

TABLE 2—VELOCITIES in fps for 1 lb of steam per hr are shown here for pipe sizes and pressures indicated

Pressure, psig		10.3	100.0	250.3
Cu ft per lb		16.3	3.89	1.74
Pipe size, in.	Lineal ft to hold 1 cu ft	Velocity, fps		
½	473.9	2.14	0.51	0.23
¾	270.0	1.22	0.29	0.13
1	166.6	0.75	0.18	0.08
1¼	96.25	0.43	0.104	0.046
1½	70.7	0.32	0.076	0.034
2	42.9	0.18	0.044	0.021

". . . If it is impractical to install a trap on each pipe, the bad effects of short circuiting can often be minimized."

Trap Multi-Coils Individually

Short circuiting is by no means limited to two or more steam heated units drained by a single trap. Short circuiting can occur in one machine with multiple steam coils or chests. Let's look at two examples.

Open-end tumblers used by laundries and dry cleaning plants usually have two heating coils, X and Y, as shown in Fig. 5. A fan draws air through both coils. Although the coils are of equal size and steam supply lines are of equal length, plant operators and tumbler manufacturers have found that greater output will be obtained with separate traps on each coil, as shown in Fig. 5b. Differences in air temperature, air velocity over the coils, and dust on the coils all make for unequal condensing rates and short circuiting. Practically all tumblers of this type are now drained with a trap on each coil.

When each chest of a flatwork ironer is properly drained — condensate removed as fast as it is formed and all air and other noncondensable gases vented promptly — the work done and steam condensed by each chest will vary with the temperature of the material passing over the chest. Since the amount of steam condensed by each chest is different, it follows that the pressure drop from the supply line to each chest will also be different.

Table 3 gives theoretical pressure drop data for an eight roll flat work ironer condensing 600 lb of steam per hr, with the load divided between the chests as indicated in column two. The actual amount of steam condensed by each chest could vary considerably without affecting the validity of the theory or our conclusions.

The eight roll flatwork ironer in Fig. 6 shows drainage by individual traps, assuming prompt removal of noncondensable gases, as well as condensate. Under these conditions, the pressure drop across each chest would be substantially the same as shown in column 4 of Table 3, assuming 10 ft equivalent length of pipe from the supply header to each chest.

Now, with all chests working at 100 percent efficiency, let's consider group trapping (Fig. 7).

With group trapping, the average pressure drop from supply header to return header would be 0.38 psig. The return header pressure would be higher than the theoretical for chests 1, 3, 4 and 5. Immediately, steam would flow from the return header to chests 1, 3, 4 and 5. While this backflow continues, no air can leave the chests counter-current to the incoming steam. Thus, noncondensables accumulate and lower the heat transfer rate and the steam consumption. If the ironer is operating at full capacity, all chests eventually will be doing substantially equal amounts of work instead of the maximum amount for each chest.

Of course, no ironer will operate at 100 percent of capacity all the time. During idle periods, noncondensables will leave the wet-end chests. But, as soon as more work goes over the machine, backflow from the return header will again block the escape of noncondensables from the chests that should do the most work.

TABLE 3—EFFECT OF CONDENSING RATES on pressure drop in an eight roll flat work ironer is shown here

Chest no.	Steam condensed	Supply pipe size, in.	Pressure drop, psig for 10 ft pipe	Pressure in chest above or below average, psig
1	145 lb	¾	0.42	−0.04
2	110 lb	¾	0.245	+0.145
3	90 lb	½	0.85	−0.47
4	75 lb	½	0.61	−0.23
5	60 lb	½	0.385	−0.005
6	50 lb	½	0.265	+0.115
7	40 lb	½	0.166	+0.214
8	30 lb	½	0.089	+0.291

Minimize Short Circuiting

No discussion of short circuiting would be complete without mentioning instances where it is either physically impossible or economically impractical to install individual traps on each pipe or chest. The old style header coil shown in Fig. 8 is a case in point.

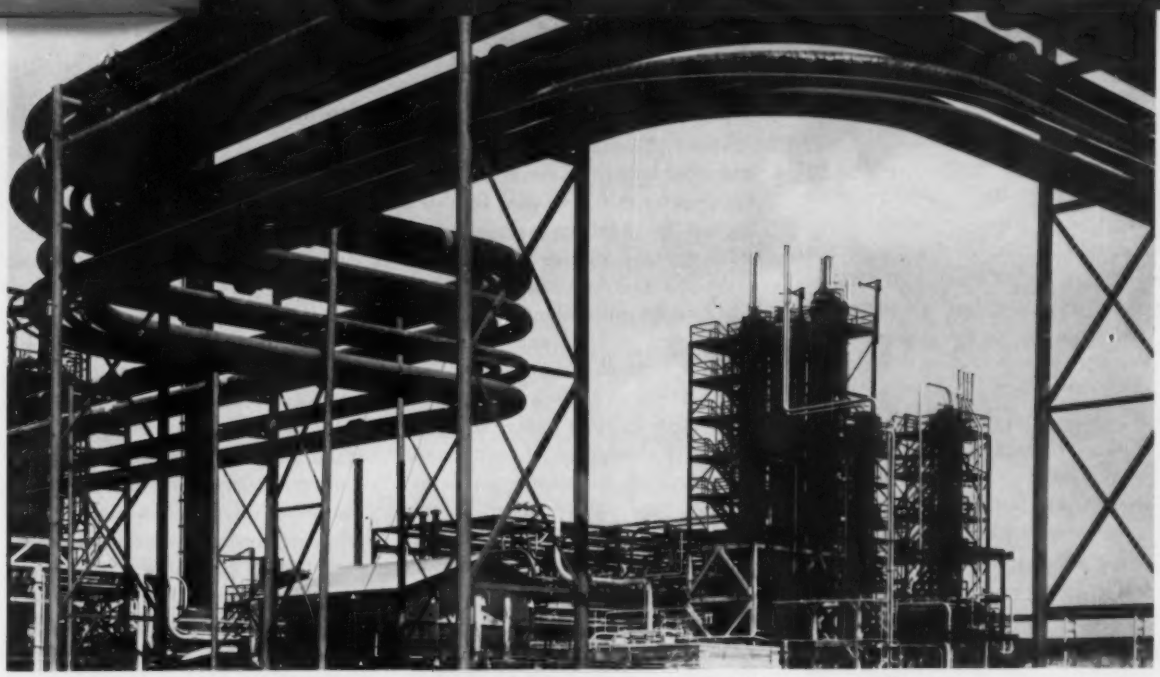
Steam will reach the drain header more quickly through one pipe than any other, pipe A for example. Once at the drain header, there is nothing to prevent the steam from entering pipes B, C, D and E, effectively blocking the escape of the air that was in these pipes when steam reached the drain header.

Assuming that it is impractical to install a trap on each pipe, the bad effects of short circuiting can be minimized by:

1) Using apparently oversized traps which will handle the condensate load more quickly, and have more time for removing air.

2) Using, at low pressures, blast type traps to get maximum amounts of air out of the coil before steam reaches the drain header.

3) Using, at high pressures, traps with larger than standard bucket vents. This is particularly effective where extra fast warm-up is not as important as maximum heat transfer from the coils.



1 NEW PIPING HORIZONS were created by parallel progress in the petroleum refining, chemical process, and central electric station industries

Centennial Marks Piping Progress

. . . many advances in the last 100 years

By G. W. Hauck
Manager, Engineering Sales
Crane Co.

• From pioneer days 100 years ago, the piping industry has kept pace with the rapid developments of industrial progress. Among the principal advances, says the author, have been: (1) the development of new steels; (2) the adoption of welded joints; and (3) the introduction of pressure-seal bonnet joint construction for high pressure-high temperature steel valves.

These developments were not spontaneous but the results of continual research and application to meet the demands of related industries that have boomed especially during the last 40 years, such as the central electric station, petroleum refining, and chemical process industries.

Here, then, is the record of piping progress in the last century, with a word about the future. Mr. Hauck, a member of HPAC's board of consulting and contributing editors, has been associated with the Crane Co. — which is marking its centennial on July 4 — for 42 years. He therefore writes from intimate knowledge of the many contributions this 100 year old company has made to piping progress.

THE MOST significant developments in piping have occurred during the past 40 years. These are the main target of our discussion here. However, this still developing industry didn't just happen.

Early Pipe Fittings Imported

Until 1845 the pipe fittings used on this continent were imported from England. The earliest production in this country was in Philadelphia, New York City, and Boston; the combined output was small. A small brass foundry was established by Richard Teller Crane in Chicago on July 4, 1855, for the manufacture of lightning rod tips and couplings. In 1857, he made an important decision. He was impressed with steam power and what its possibilities were for industry. His decision was to tie his future to steam by entering the steam heating business and by jobbing pipe and fittings.

In 1858 a contract was secured for a steam heating system for the Cook County Courthouse. In carrying out this contract large quantities of fittings were required which caused him to take up the manufacture of these goods, including globe valves, check valves, steam cocks, and the like. This was the beginning of the line that soon became the company's principal business.

Pipe was produced by his company from 1864 until 1905, the company having built the first iron pipe mill west of Pittsburgh in 1864.

Further expansion took place in that year of 1864 with the first malleable iron foundry west of Pittsburgh. A three-story structure contained a grey iron foundry, brass foundry, malleable iron foundry, malleable annealing department, machine shop, etc. The business had expanded from a one-man shop to an establishment giving employment to 200 people.

Until about 1890 the demand for fittings and valves continued with little change except for a gradual increase in sizes and varieties. But about this time there started an appreciable wave of progress that extended throughout the following 20 years.

Pipe Sizes Get Bigger

Up to 1882 electricity had been generated largely by steam engines in factories for their own uses. But when its use for lighting became practicable, private utilities began to generate electricity in central stations. The first central station in New York was started in 1882 and in Chicago in 1888. In 1892, the Chicago Edison Co. developed 3180 kw, the other about 3500 kw, or a total of 6680 kw.

The establishment of central stations created a demand for larger engines, and this in turn brought about a need for larger sizes of piping materials. Flanged fittings came into widespread use. It's interesting to note that end flanges and drilling templates were first standardized through the cooperation of manufacturers, engineers, and the American Society of Mechanical Engineers in 1894.

As early as 1888 a chemical laboratory devoted to production control was established in Chicago. In 1895 a metallurgist succeeded in bringing cast iron up to a uniform tensile strength of 20,000 psi. This is believed to be one of the first scientific and systematic efforts to achieve uniformity in metals used in similar products.

Stronger Materials Required

Compound steam engines and steam turbines entered the field, leading to increased steam pressures, running as high as 250 lb. The result was extra heavy piping materials and still larger sizes. Dimensions and drilling templates for extra heavy, 250 lb flanges were first standardized by manufacturers in 1901.

Ordinary cast iron valves and fittings soon proved inadequate to withstand the strains of expansion and contraction of piping under the advanced temperatures. A higher grade of cast iron was developed in the early 1900's. Adding 20 percent Bessemer steel to pig iron increased the tensile strength from 20,000 to 30,000 lb. This new high strength cast iron — dubbed "semi-steel" at the time — made possible higher service recommendations, including some superheated steam.

Cast Steel Emerges

As superheated steam came into wider use, the higher temperatures and greater pressures outmoded the high strength cast iron products. Cast steel came into being for valves and flanged fittings. In 1907 piping specifications were published in *Valve World* for high pressure plants, with superheated steam service of 250 lb and 200 F of superheat. This was a distinct advance.

More Research Enables Advance

Pioneering research ventures were expanded in scope and developed consistently without a break during the ensuing years. L. W. Spring's high temperature studies on the behavior of metals at various temperatures were first published in *Transactions* of the International Association for Testing Materials in 1912. These studies and related research activities were a significant step in developing the background for high temperature piping design established prior to 1915.

New Vista Follows World War I

The evolution that took place in piping materials up to 1915 served the needs of industry adequately. Important also, it provided excellent

Crane Co. 100 Years Old July 4

A CENTURY AGO, on July 4, 1855, Richard Teller Crane at the age of 23 started a brass and bell foundry in a one room frame building that he built in his uncle's lumber yard in Chicago. From such humble beginnings has risen the multi-million dollar Crane Co. of today, the world's largest producer of valves and fittings.

R. T. Crane's first castings were tips and couplings for lightning rods. Products today range from gate valves as big as a door to electronic transistors no bigger than a thumbnail. Valves, fittings, fabricated piping and piping accessories account for 65 percent of the sales of products manufactured by the company.

Almost from the first, the company has stayed consistently in the valve and pipe fittings and pipe fabrication business. The company no longer makes pipe, but still jobs it.

At present, Crane Co. is engaged in the manufacture and distribution of valves, fittings, fabricated piping and piping accessories, heating equipment, accessory equipment for aircraft, plumbing equipment and many other items.

In commemoration of its 100th year, Crane Co. will dedicate a $25 million titanium ore processing plant at Chattanooga, Tenn. While most of the initial output will be channeled toward Air Force requirements, the company foresees the use of titanium in valves and fittings for use under highly corrosive conditions.

groundwork for the industrial expansion and the immense progress in the next 40 years.

In 1915 steel castings, still in their infancy, comprised only a few lines of steel valves and fittings. Essentially, the industry was working with brass, malleable iron, and the cast irons. We had standard, extra heavy, and hydraulic pressure classifications. Screwed ends and flanged ends predominated.

Piping work, being confined to these few basic materials and types of end connections, was relatively simple contrasted with today's requirements. This is not intended to belittle those achievements prior to 1915. Instead, any oversimplification is merely to bring into sharper focus the fact that those early achievements became a springboard for the gigantic steps of progress that were to follow.

Forty Fruitful Years

1915 to 1955 — this period of my own working lifetime — can only be recalled as 40 fruitful years. From this period emerged many previously undreamed of piping materials, radically different types of joints, and new technologies—so numerous that it's impossible to deal here with all or even with most of them.

Of the many developments which have challenged producers and which have resulted in the array of piping materials and techniques we have today, the three that seem to me to have made the greatest impact in the over-all progress are:

1) The expanded use and development of steel materials.

2) The adoption of welding techniques in making piping joints.

3) The advent of pressure-seal bonnet joint construction for high pressure-high temperature steel valves.

Steel for Piping Grows Up

These 40 fruitful years have been the age of steel. In this time steel materials for piping really grew up. Following the first steel castings in 1907, they expanded in variety and usage. In 1919 our production of electric furnace steel was started with a 6 ton furnace. In 1923, Mr. Spring, a metallurgical authority, recorded: "At 700 F, the usual top of the superheated steam temperature range, steel has a tensile strength of 69,000 psi and a yield point of 36,000 psi."

Also in 1923, carbon steel valves and flanged fittings were listed for 300 lb at 800 F, 350 lb at 800 F, and 500 lb cold water working pressure. This was indeed a modest line compared with the array of steels and the pressure classifications that followed during this period.

In these early 20's several industries began to forge ahead rapidly. The impact upon piping materials and the demand for more steel and alloys came primarily from three industries: central stations, petroleum refining, and chemical process plants.

Pressures, Temperatures Rise

The central station industry, with its beginnings in the previous century, started taking giant strides in the early '20's. It can take credit for a great deal of pioneering achievement. The growth can be appreciated from a brief review of the evolution of operating pressures and temperatures.

For example, Commonwealth Edison Co., of Chicago, operated in 1891 at 175 lb, in 1903 at 200 lb, and in 1912 at 250 lb. In 1917 the Calumet and Joliet stations were up to 325 lb. Stations in 1923 were operating at 375, 400, and 600 lb, and a top temperature of about 750 F.

An advertisement in 1923 announced as newsworthy a steam pressure of 600 lb with a temperature of 750 F. The ad includes a provocative question: "*What will pressures be in* 1955*?*" A lot has happened since that question 32 years ago. We know the answer today.

In the light of developments between 1923 and 1955, it would have been even more provocative to have asked then, "*What will temperatures be in* 1955*?*" About 1928 it was thought that we were going all out in pushing temperatures up to 800 F. From then on the surge toward higher and higher temperatures had more to do with the development of steels than did the pressure rises. Investigations of materials that would resist creep were responsible for new alloy steels.

2 VALVES AND OTHER PIPE FITTINGS remained small until a wave of progress began about 1890, when central stations boomed for electric lighting. Shown is a pressure-seal bonnet type valve

Develop Alloy Steels

From the carbon steel we moved into the use of carbon-moly steel. It sufficed until some failures due to graphitization occurred in steel pipe associated with weldments. Then the industry developed chrome-moly steels with varying contents of chromium and molybdenum, also some other variations of alloy steels.

Developments in steel materials found a need for further standards. In the American Standard for Steel Flanged fittings and Flanges, ratings for the first printing, approved in late 1926, were for 250, 400, 600, 900, and 1250 lb. Later, standards were established for 150, 300, 400, 600, 900, and 1500 lb, and still later for 2500 lb. Adjusted pressure-temperature ratings in current

use define limits of usage and are authoritative guides, a noteworthy advance when regarded in retrospect. Steel materials are being studied today for temperatures up to 1150 and 1200 F.

Alloy Valves Serve Refineries

Like the central stations, other industries forged ahead in the same period with new technologies, improved processes, and a host of entirely new products.

A demand for alloy steel castings started in the oil industry about 1923, with a request for refinery valves cast in a low nickel-chromium-molybdenum steel. Another alloy steel, 4-6 percent chrome-½ percent moly, followed about 1928 for piping materials that would provide superior corrosion resistance to hot corrosive petroleum vapors.

The demand for higher alloy steels was also present, for by 1928 valves were being made of 18-8 chrome-nickel steel. Castings and forgings of many other alloy steels have been developed also, as the needs demanded them.

Chemicals Have Varied Needs

The chemical process industries followed a similar pattern. A demand was created not only for alloy steels for higher pressures and temperatures but for a wide variety of corrosive services as well. Still other alloy materials were required to withstand sub-zero temperatures.

Other industries contributed their needs in building up a constantly expanding demand for various types of steels. Much of the constant progress in many industries was paced by the advances in pressures and temperatures, which in turn were dependent upon adequate steels for piping. The development of special steels was, therefore, an important factor in the over-all progress achieved in piping.

Welding Overcomes Objections

Today welding is a common method for assembling piping joints. Yet a 1911 *Valve World* article with a picture of two 32 ft long headers with six 6 in. and one 3 in. welded nozzles explicitly stated that "such welded construction could not be considered as equal in strength or longevity to cast steel." While the shop fabricated headers of those days were made with reservations, there had been no failures of such moment as to warrant this apprehension.

In 1919 another article, "Welded Versus Flanged Joints," did not favor welding, "especially where the line was to carry any considerable pressure or expansion strains." Emphasis was placed on "safety first" because welding was on trial.

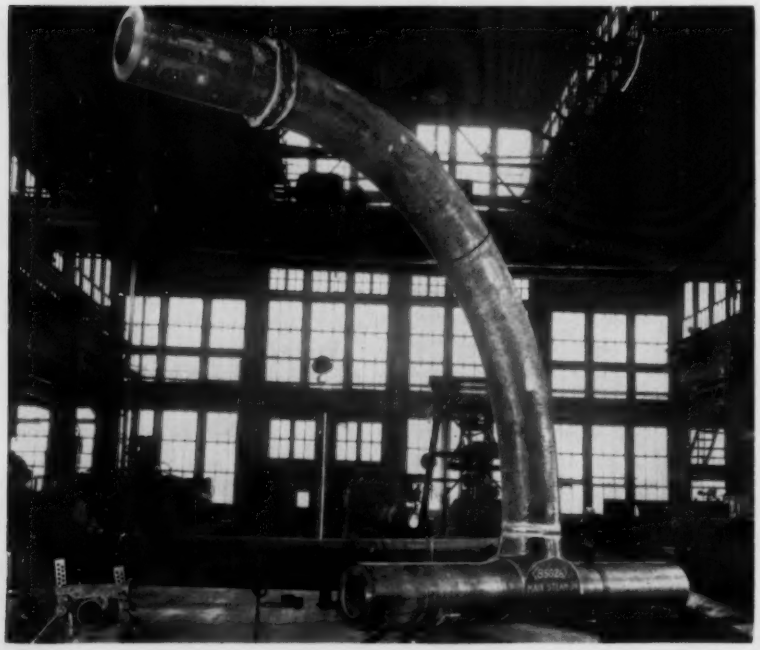
Welding fittings began to appear in 1927. By the early '30's an increased range of sizes and types was available, as well as steel welding flanges.

Here's an interesting old quotation: "The art of fusion welding being rather new, there is considerable divergence of opinion among engineers as to the kinds of service for which it is permissible. Few object to its use for air, water, steam, and gas lines up to 50 to 75 lb pressures and with moderate temperatures; while some piping work is fusion welded for pressures up to 200 lb. Code and insurance regulations and state laws should be consulted when extraordinary work is contemplated."

Was this written in 1915 or 1920? No, this quotation is from Walker and Crocker's "Piping Handbook," first edition, published in 1930 and authoritative at that time. The limitations of screwed joints and flanged joints had to be overcome. Within a short time, welding began giant strides, similar to the evolution we have traced for steel materials.

Continue Welding Research

The cooperative effort of many industries, laboratories, and research groups raised welding from an unproved, doubtful status to the predominant place it now occupies. Welding has been developed to the point where its use is permitted for practically all classes of pressure piping. But, such welding is done under controlled conditions and is backed up by welding technicians, definite procedures and supervision, plus continuous research in the formation and testing of welds. Effective methods for stress-relieving and heat



3 EXTRA HEAVY PIPING MATERIALS and larger sizes, as in this main steam header, were demanded for higher steam pressures and temperatures

treating, and nondestructive testing round out a sound technique today.

From a timid approach in the early '30's, we have progressed to the welding of extremely heavy piping, as shown in Fig. 3. It shows 2¼ percent chrome-1 percent moly piping, 17¾ in. outside diameter, with 3¼ in. wall thickness, for steam service of 1970 psig and 1050 F.

Welding end steel valves first appeared in a limited way about 1935; they are commonplace today. Welding has also become an indispensable tool in many other ways, for example, the depositing of stellite on seating surfaces of valve parts.

Thus, welding rates as another important milestone of progress.

4 INERT ARC WELDING of stainless steel and alloy piping is one of the most recent advances in the development of piping materials and techniques

Design Pressure-Seal Bonnets

Within the past 10 years we have witnessed the advent of the pressure seal bonnet, a radically different type of bonnet joint for high pressure and high temperature steel valves.

In the higher pressure classes, conventional valves had considerable bulk, particularly in the bonnet joints. Creep and the maintenance of tightness in such joints under high temperatures are familiar problems. These bonnet joints also were troublesome when subjected to sudden quenches. In the older type valve, the internal pressure is trying to literally blow the bonnet off the body. In the pressure-seal design, the internal fluid pressure is utilized to seal the bonnet.

Because of its elimination of many problems, pressure-seal design justifies its inclusion as one of the three highlights of piping progress.

Other Notable Advances

It's impossible to conclude this story of piping progress without mentioning a few other important advances.

American Standards Association and its Sectional Committee of Pipe Flanges and Fittings has performed a great task since 1925 in clarifying pipe fitting products. These standards have greatly simplified these products, to the benefit of both manufacturers and users. Similarly, specifications of the American Society for Testing Materials and the American Petroleum Institute have played an important part in piping progress. We owe much to those who developed them.

The ASA *Code for Pressure Piping*, first published in 1935 and since then revised several times, has become "the bible" of piping. How did we ever get along without such a document in those earlier days? This also applies to the ASME Boiler and Pressure Vessel Codes as they affect piping.

Metallurgists not only developed the required steels and had a great deal to do with advancing welding techniques, but improved materials for valve stems and seating parts, and for bolt-studs. These are just a few of their achievements. The manufacturers of pipe and tubing have kept pace by supplying new products and alloys as the need arose.

There has been steady progress also in the development of the solder joint for tubing, fittings, and valves.

Notable advances also have been made in the technology of stress calculations, and in providing adequate flexibility in piping. There has been much progress, too, in the suspension of piping and compensating for movements.

Piping Will Keep Pace

Piping materials have gone far in the last century, particularly in the last 40 years. This review is but a light skimming of the high spots. What's ahead in piping? That's a most intriguing speculation.

For one thing, plastic piping materials seem destined to become increasingly useful. For another, pioneering work is already under way for boiler-turbine-generator units using super-critical pressures in central stations. Naturally, many new developments in piping materials will stem from nuclear power plant designs and other applications of atomic energy.

Thus, new horizons are still ahead. And, if the record of the past is any indication, the promise of the future will be realized.

1 CEILING AIR DIFFUSION via acoustical air baffles can successfully heat space when relatively high air quantities are used

Distributing Air without Draft

. . . Sound absorbing grid supplies air for heating

By L. G. Seigel

Associate Professor
Heat-Power Engineering
Case Institute of Technology

AMONG THE ADVANTAGES marking the trend toward luminous plastic ceilings are high quality lighting and effective sound absorption. As a result of the popularity of such ceilings, there has been much interest in the development of methods of air distribution which use the ceiling itself as a means of air diffusion.

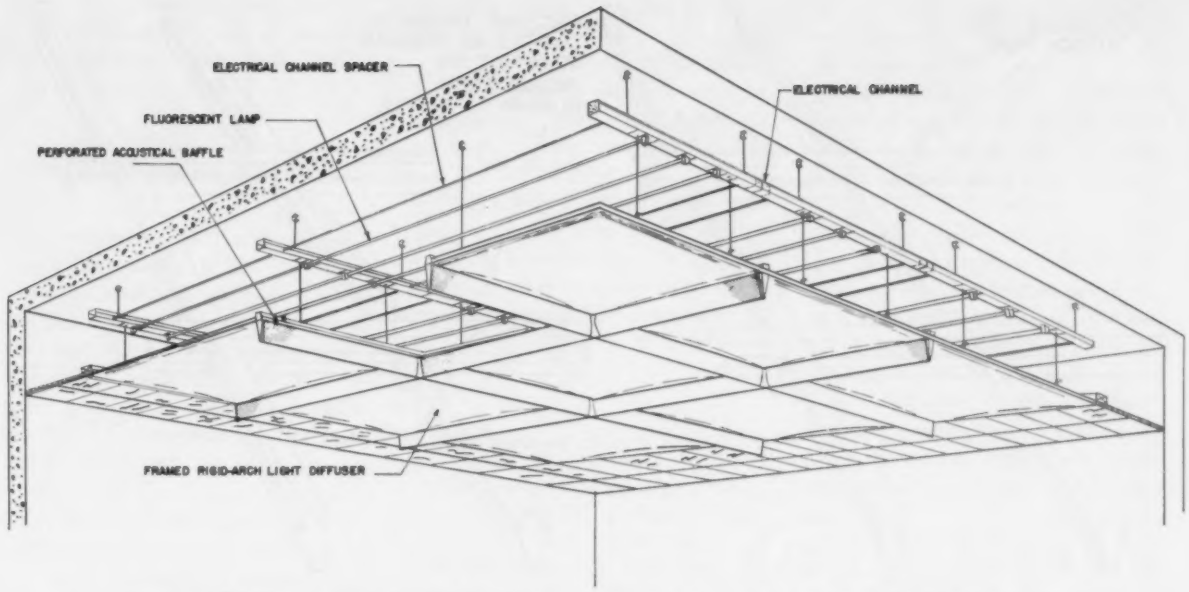
Also, in the past two years interest has increased in the use of low velocity ceiling distribution systems for warm air heating. This article is the result of tests conducted on such a system used in connection with a pan type luminous ceiling.

The ceiling and baffle system used for these tests was similar to that shown in Figs. 1 and 2. It was installed in a specially designed test room having two sides and the floor and ceiling exposed to a controlled low temperature air space. The room was 13 ft x 18 ft x 8 ft high. Large windows were in the walls having the cold exposure. The heat loss of the test room was about 7000 Btu per hr at zero F outdoor with 73 F inside.

A previous article by the author and W. L. Bryan in the September 1953 HPAC gave the results of air diffusion tests of a corrugated type luminous ceiling.

Supply Warm Air Near Walls

Warm air was supplied to the five acoustical baffles nearest the cold walls through 4 in. round flexible ducts attached to transition pieces shown in Fig. 3a. An alternate air supply for plenum type systems is shown in Fig. 3b. Baffle dimensions are shown in Fig. 4. Dampers were provided so that any or all of the baffles could be used at the same



2 LUMINOUS CEILING, as shown here, was installed in a specially designed test room 13 x 18 x 8 ft high

from Baffles in Lighted Ceiling

or cooling by either plenum or duct feeder system

time. Air quantities were measured by the thin plate orifices. Room air temperatures were measured by thermocouples and thermometers spaced 1 ft apart on vertical poles at different positions to determine the floor to ceiling temperature gradients. The bottom thermometer was 3 in. from the floor and the top thermometer was 1 ft from the ceiling.

High Return Double Air Change

The results of tests for air flow vs. pressure at the baffle are given in Table 1, and the results of heating tests showing temperature gradients in the space are given in Fig. 5.

No objectionable air velocities were encountered in the test space. Therefore, the major factor affecting thermal comfort was the temperature gradient. This gradient, which was found to depend on the temperature difference between the supply and return air, was not seriously affected by the number of baffles used or the number of air changes.

The location of the baseboard return air intakes had no noticeable effect on the temperature gradient. Preliminary studies now in progress indicate that the use of high sidewall returns has an adverse effect on the temperature gradient. To maintain the same temperature gradient with high returns, a smaller supply to return air temperature difference is required. This means that for the same heat loss, a greater air change is needed. At present, it appears that to obtain equally satisfactory temperature gradients, high returns require about twice as much air change as low returns.

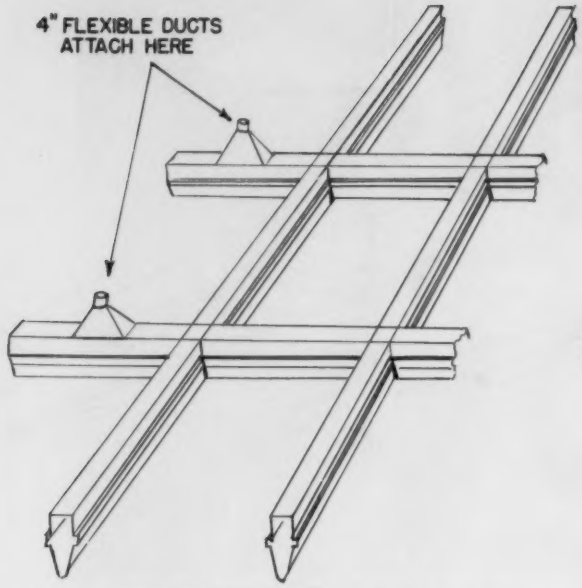
TABLE 1—NUMBER OF BAFFLES to be used can be determined by setting a value for the air quantity to be handled per baffle. Air flow capacities of air diffusing acoustical baffles is indicated here

Air flow through baffle — cfm	Pressure at inlet to transition piece In. of Water	
	Static	Total
40	0.015	0.029
47	0.017	0.036
48	0.019	0.038
91	0.039	0.108
107	0.055	0.150
123	0.065	0.190

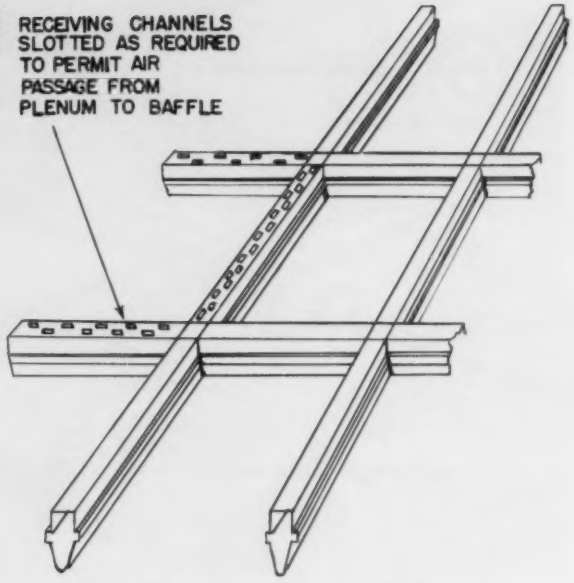
Limits: a) At 70 cfm, noise in the 4 in. connecting duct becomes objectionable.
b) At 130 cfm, 50 fpm air velocity occurs 2 ft below ceiling.

How to Apply Data

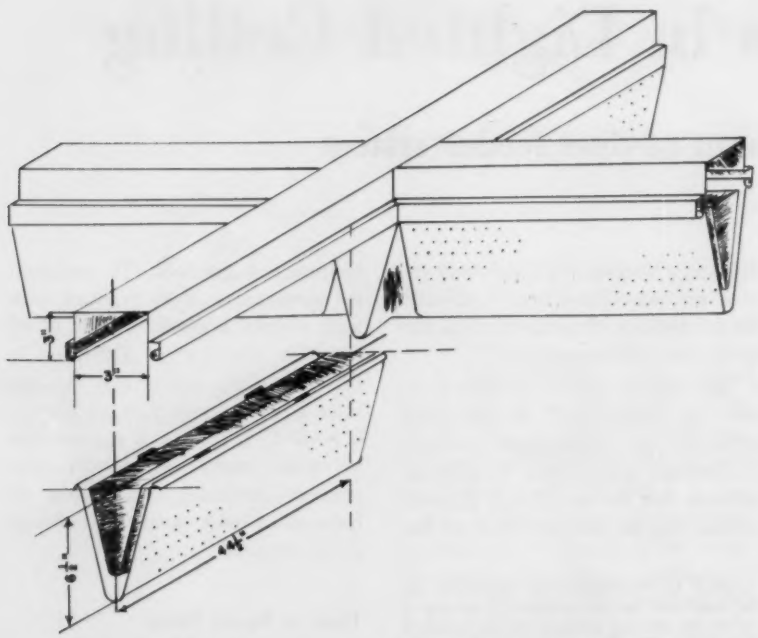
In order to apply the above data to an actual design, it is necessary to establish the number of baffles to be used and to select a satisfactory temperature gradient. If a gradient of 6 to 8 F is considered reasonable, the temperature difference between supply and return can be determined from Fig. 5. This temperature difference can then be used to compute



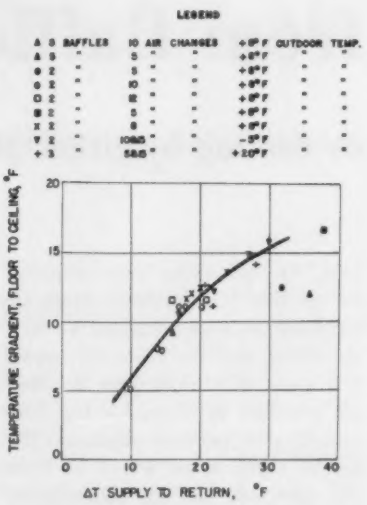
3a TRANSITION PIECES conduct warm air from 4 in. flexible ducts to the acoustical baffles nearest the cold walls



3b PLENUM TYPE AIR SYSTEM, instead of flexible duct type, may supply warm or cool air to baffle diffusers



4 BAFFLE DIMENSIONS are 6½ in. high x 44½ in. long for the visible sections, above which are 3 x 3 in. channels



5 TEMPERATURE GRADIENT, major thermal comfort factor, depends on the temperature difference between supply and return air, not on the number of baffles or number of air changes

the air quantity which must be supplied to the space. Next, the number of baffles to be used can be determined by setting a value for the air quantity to be handled per baffle. See Table 1. Two limits may be set for the maximum air quantity that can be supplied through a given baffle. One is set by the noise generated in the 4 in. connecting duct at 70 cfm. The other is set at 130 cfm as the maximum that can be discharged from the baffle without causing objectionable velocity — above 50 fpm — 2 ft below the ceiling. Of course, to obtain the 130 cfm maximum, it would be necessary to use larger than 4 in. connecting ducts

or to ignore the noise limitation.

To illustrate the use of the data presented, here is an example worked out in detail.

How Many Baffles Are Needed?

Problem: A space to be heated has a volume of 3000 cu ft and had a design heat loss of 12,000 Btu per hr, with an outdoor temperature of zero F. Determine the number of acoustical baffles to be used for heating the space with warm air if the temperature gradient in the space is not to exceed 7 F. Returns are to be located in the baseboard.

Solution: For a space gradient of 7 F, the supply to return temperature difference may be taken from Fig. 5, at 12 F. Then the air quantity may be computed from the heat loss as follows:

$$12{,}000 = 0.24 W_a \times 12$$

W_a = 4170 lb per hr = 950 cfm = 19 air changes per hr

a) If the baffle air quantity is limited by noise in a 4 in. supply duct, the number of baffles would be 950/70 = 14 baffles.

b) If the noise can be eliminated by use of a larger supply duct, or by plenum supply, the 130 cfm limit can be used and the number of baffles can be 950/130 = 8.

c) If a high return is used, the air quantity would have to be doubled and this would be directly reflected in the number of baffles so that between 16 and 28 baffles would be required, depending on the cfm limit used.

Advantages of System

The results of these tests indicate that it is possible to heat a space successfully with ceiling type air diffusers when relatively high air quantities are used. The advantages of such a system are:

1) The appearance of the ceiling is not affected by the addition of special air outlets.

2) The same system may be adapted for heating and cooling.

3) Large air quantities may be handled without drafts. This is due to the large free area provided by the perforated baffles.

The tests reported here are for well insulated spaces with double glazed windows or storm sash. If single glazed, poorly fitted windows are used, the system will not perform well near the windows when low outdoor temperatures are encountered. To eliminate this condition, heat should be supplied under the windows by direct radiation or by baseboard type warm air supply registers. If no heat supply is provided under single glazed, poorly fitted windows, this system should be restricted to applications where the outdoor temperature is not less than 30 F.

Since large air changes result in a low temperature air supply, the system described here is admirably suited to heat pump applications. In such applications, the full advantage and flexibility of the system for year 'round service can be appreciated.

The author wishes to acknowledge and thank the F. W. Wakefield Brass Co. for the equipment used in these tests.

New Houston Post Plant Gets Automatic Cooling

. . . *twenty-six zones*

A "SUPER" AIR CONDITIONING system has been installed in the Houston Post's new $4 million plant. The air conditioning, heating and ventilating system was installed at a cost of $200,000.

The building is of modern design, with no windows except for the second floor office section, and contains about 120,000 sq ft of floor space. The two story front portion is the office section, while the three story rear section encloses the mechanical departments, so that the complete structure is part office building and part industrial plant, complete with cafeteria and paper warehouse.

Cooling requirements of the present structure, as well as future upper floors, are taken care of by two compressors, of 150 and 250 hp, respectively. The combined cooling capacity is 400 tons. Chilled water is supplied to 26 zone air handling units. Filtered and cooled, or heated, ventilating air, is also supplied to the zone units by a central medium pressure primary air unit of built-up construction. During summer operation, the water and primary air are both supplied cold. With outside conditions between 65 F and 55 F, the air is heated, and the water is kept chilled. When the outside dry bulb drops below 55 F, the air is supplied cold, and the water is heated. Some portions of the building require cooling at the winter design temperature of 20 F.

Automatic electronic controls select air and water temperatures and start the gas fired boiler, or start the refrigeration equipment as required. Zone units have electronic damper and valve controls. The most unique feature of the control system measures the building load from the chilled water. It selects the small compressor with its chilled water and condenser water pumps, or the large compressor and its pumps, or both machines and all four pumps.

CONTROL PANEL has built-in miniature temperature and flow indicators which automatically start, stop compressors

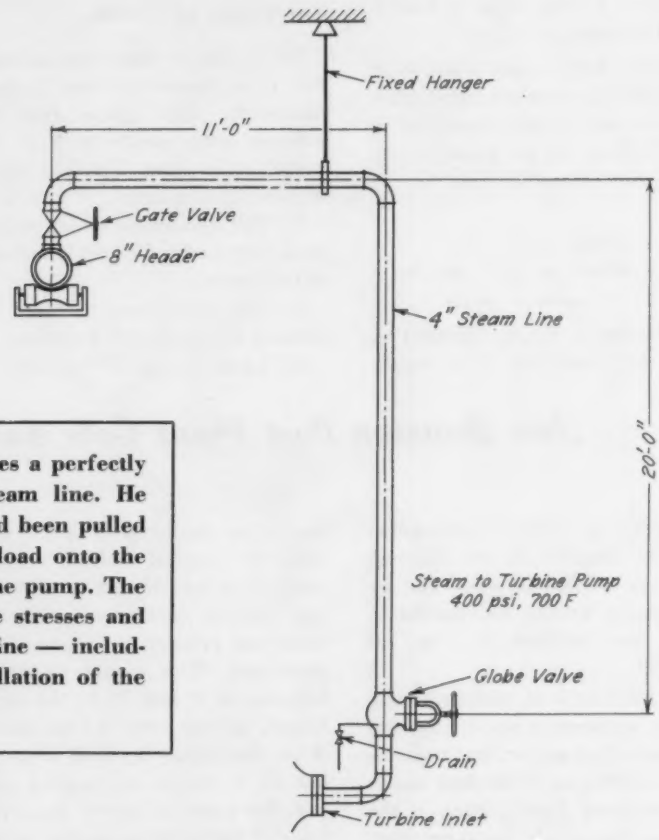
The system was designed by C. V. Chenault of Herbert Voelcker and Associates, and installed by the Wood-Leppard Air Conditioning Co.

PRACTICAL PIPING PROBLEMS

By Bill Dopp

Fixed Pipe Hanger Shifts Load

. . . causing excessive vibration of turbine driven pump on new steam line



• Mac spots the trouble when he sees a perfectly rigid pipe hanger in the 4 in. steam line. He guesses correctly that the hanger had been pulled up cold, which forced the reaction load onto the vertical line connecting to the turbine pump. The problem is solved by re-figuring the stresses and loads and the weight of the vertical line — including pipe covering — plus the installation of the correct constant load hanger.

MARTIN MACVANE, gasket salesman, stood in the doorway of the office of Richard Ellis, superintendent of the Smithson Products Co. His old friend and Mel Stevens, the chief engineer, seemed to be deep in a serious conference. Mac was about to withdraw when they both looked up.

"Hello, Mac," said Dick, extending his hand. "Come on in."

"Hi, Mac," echoed Mel.

"Hello, fellows," said Mac. "I don't want to interrupt, if you're busy. Just thought I'd drop in."

Dick waved him to a chair. "Always glad to have you, Mac. We don't need any gaskets, though." Dick became serious. "Do you know, we are using fewer and fewer of those things. In fact, we just got through erecting a new steam line. We only used one gasket. That was on the turbine connection. All the other joints in that line were welded." He laughed, "You'll soon be out of business at the rate welding is taking over."

Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch as a sales engineer. He is devoting part of his present leisure to writing of his many piping experiences. All the names used are fictitious.

"That's what you think," Mac said. "You still have to put something into valve stuffing boxes. When somebody solves that problem, I'll really retire."

"Things are changing all the time," declared Mel. "They'll solve that one yet. But in spite of the progress, we still have our problems."

Mac looked at him with new interest, sensing something out of the ordinary. "What's got into your hair?" he asked.

"Mel bought a secondhand turbine driven pump from the Plover Co. Now that he's got it installed, he can't make it work," said the superintendent. "I'll admit I'm pretty much puzzled myself."

"Won't it run?" Mac asked.

Pump Runs But Vibrates Badly

"It runs all right, as far as that goes," said Mel, "but it gets to vibrating so bad you'd think it would shake down the whole building."

"What did you do, buy a pig in a poke?" Mac laughed.

"No! We saw that pump running several times. It purred like a kitten. My friend Wilson, the engineer at Plover, swears that he never had a day's trouble with that turbine or pump. I believe him, too."

"So would I," Mac said. "Why did they sell it to you?"

"We needed a larger pump," explained Dick. "We'd been handicapped for a long time because our pumping capacity was too low. They had changed their processing so that this pump was far too large for their present needs, and they wanted room to place other equipment. Mel got to talking with Wilson and the result was that we bought it. I'm satisfied that it was all right when we made the deal."

"Who moved it?" asked Mac.

"Our regular machinery movers. They're always careful and there is no reason to think that they damaged it. Now you're going to ask 'Who set it?'" Dick squinted at Mac. "Well, we did and we did a good job, if I do say so." He spread his hands out. "It's dead level in every direction."

"Still it vibrates," mused Mac. "You fellows did something to that pump. What?"

Vibration Worse as Pump Runs

"I can't figure it out," declared Mel. "We took every precaution in handling and setting it. There's a funny thing about it, too. When it first starts, the vibration is not so bad, but it keeps getting worse as she gets going. We haven't let it run for more than a few minutes at a time."

"Sorry I can't help you out of this," Mac said. "Guess you'll have to fight it out for yourselves."

"We were discussing taking the turbine apart when you came in," said Dick. "Mel thinks that maybe he could find the cause if he had it apart. It's possible that one of the balance plugs has become loose."

"Have you ever had one of those things apart?" Mac asked. "Don't do that until you're up against the last resort. What about the manufacturer?"

"That machine is at least 15 years old, and the maker doesn't owe us a thing," laughed Mel. "I'm afraid he would be unwilling to come in and straighten us out now."

"Would you like to come on down and take a look at this baby, Mac?" asked Dick. "We've got to do something about this. Perhaps our thinking will be sharpened if we are looking at it." He grinned. "It does help sometimes."

Mac Surveys Piping

As they stood beside the silent machine, Mac carefully sized up the location, particularly the piping. He studied the header from which the new steam pipe came. The neatly covered steam lead to the turbine had a throttle valve near the bottom, with an adequate condensate drain above the disc. Approving, he asked, "Who laid out the piping?"

"Mel did," said Dick.

"Figure your stresses, Mel?" Mac asked.

"Sure did! Everything is within the code requirements. I made sure of that," Mel said with pat certainty.

"Cut the line short?" Mac asked, studying the line above his head.

"Yep, 50 percent of the expansion." Mel winked at Dick. "Everything's in order, Mac."

"Everything but . . . . who designed the hanger?" Mac asked. Mac walked a little distance away. The group took a few steps, their attention fixed on the horizontal line from the header to the drop down to the turbine. The others followed him.

"But what?" Mel demanded. "I designed the hanger. It's more than strong enough."

"So I see," said Mac. "Did you figure your reaction loads?"

"Why . . . . Gee whiz, Mac! The stresses were well within the allowable under the code, so the forces must be okay." Mel had a funny puzzled look.

What's Pump Inlet Load Limit?

"Go on, Mac." Dick urged, "What's the catch?"

"Mel, did anyone tell you what limit load the manufacturer put on that turbine inlet?"

"Why no," answered Mel, casting a disturbed look at the superintendent.

"Mel," said Mac, "every turbine manufacturer is very insistent that the loading of his turbine from piping structures be kept below a certain maximum that he sets when he sells the turbine. I'd say that on a small machine like this that 650 lb would be about it. If you get above the set maximum, you will disturb the balance of the machine, and vibration will be the invariable result."

"Oh, Oh! I'm in trouble, Dick," exclaimed Mel.

"Looks as though you were," agreed Dick. "What's the rest of it, Mac? I can see that you've got something else up your sleeve."

Expansion Stresses Set Up

"Take a good look at that set-up," suggested Mac, "When that line expands, you set up expansion stresses in both the horizontal and vertical legs of the line. These stresses produce reaction loads on the ends of the line. It's really a 90 degree bend.

The shorter leg has the higher stress; so, the greater reaction load is on this end of the structure at the turbine inlet."

"I can see that now," said Mel, "but you seem to think that there is something wrong with the hanger. "What's the matter with that?"

"Just about everything," said Mac. "What have you got under that covering?"

"It's a double bolt pipe clamp. I forged a special clevis and we put in an extra heavy rod. Made the beam clamp ourselves, too." There was a trace of pride in Mel's assertion.

"I suppose you pulled the clamp up good while the pipe was cold, too?" Mac guessed.

"Sure," answered Mel promptly, failing to catch the trend of Mac's thinking. Dick raised one eyebrow questioningly.

Transfer Load to Pump Inlet

"Then when you get the pipe hot, you take all of the load off the hanger and blandly transfer it down here onto the turbine inlet nozzle."

"Wait a minute," demanded Mel. "How do you get that way?"

"Suppose that there is 1 in. of expansion in that vertical line," Mac said. "You cut the line cold ½ in. short. Disregard the code for a moment. "Lift that horizontal line with expansion or with a jack — it does not make any difference which — and there is no load left on the hanger. In this case, however, you have done the lifting with the vertical line, so that there is nothing to support the weight of the line but this lower elbow. That's attached directly to the turbine nozzle and puts the weight load as well as the stress load at exactly the place where you don't want it."

Entire Weight Was on Hanger

"But Mac," expostulated Mel, "we set up that hanger before we bolted up the turbine joint. The entire weight load was on the hanger. That much I know."

"No doubt you are correct in that, Mel, but the moment you apply heat to that line, things change rapidly. Expansion is an irresistible force. It does some funny things. Some of its tricks are very subtle. This trick of shifting weights is one that gets many designers into trouble, just as it has you. The expansion or contraction of one vertical line can throw a whole piping system out of balance."

Mac pointed to the delinquent hanger and continued. "Every hanger becomes, to some extent, a fulcrum. If the load on one side of the hanger is very much heavier than the load on the other side, the heavier load will tend to lift the lighter one, just as the weight on a beam scale lifts the balance weights. It is very important that these balances be taken into consideration when you are designing the support of a pipeline."

Thought Piping Was Simple

Mel glanced over the piping with a puzzled look. "I never thought hanging piping was so very complicated. Look at that header up there. It's riding on a lot of rollers and that's that. There are a half dozen lines entering or leaving it, some to the right and some to the left. We've never had any trouble with any of those lines."

Mel was not convinced. Mac led him over to another vertical line at the other side of the room. "Take a look at that hanger, Mel. You will notice that the roller is supported on springs. Why?" Pointing to the lower end of the line, Mac said, "Here you have a base ell. That will support the weight of this vertical line whether it is hot or cold, but the designer has taken the precaution to divide the load, putting part of it on the hanger. He put the springs up there under tension so that when the line heats up, the springs will compensate for the changing load still carrying part of the weight. All of the reaction from the expansion stress at this end of the line will be carried on that ell, however. Now if that header moves along its major axis, there will be torsional forces acting on the ell, too."

"Do you think that the fellow who designed this piping system took all of that into account, Mac?" asked Dick.

"Of course he did, if he was a competent designer," declared Mac. "Only by realizing that supporting piping is just as important as any of the other four fundamentals of piping design can any designer turn out a trouble free piping system."

"What do you mean by the other four fundamentals?" Mel asked.

Must Meet Five Fundamentals

"There are five fundamental problems that must be adequately met in the design of any piping system," explained Mac. "They are selection of the proper materials, adequate control of the fluids, flexibility for expansion and operation, support, and insulation. Unless you meet the requirements of each of these, your pipe line will be unsatisfactory. Any one of them is just as important as any of the others."

"In other words, amateurs should not try to design pipe lines," laughed Dick.

"Exactly," agreed Mac.

"That sets up my status," exploded Mel, clearly miffed.

"Not at all, Mel," Mac said. "The best engineering firms sometimes pull surprising boners. The problem of support is very important. It's just as important as the selection of the correct valve or the proper weight of pipe."

Load Shift Makes Pump Vibrate

"You think that it's the shifting of the load in this steam line that makes this turbine vibrate, Mac?" asked Mel, turning back to the pump.

"Yes," said Mac. "Whenever you impose an unusual or an eccentric load on the casing of a turbine or a pump, or on any other apparatus for that matter, you throw that piece of equipment out of balance. It will either protest by squealing or by vibrating, or both. The vibrations will be transmitted to the piping and may be accelerated in the piping structure. It can be transmitted to the main header. Just because you don't have

any flanged joints doesn't mean that it can't do a lot of damage."

"It really had us all scared," said Mel. "How am I going to fix this thing? Got any ideas?"

Check Stresses Twice

"Re-figure your stresses," said Mac. "Remember that you can take credit for only one-third of the stresses and loads because of the 50 percent cold pull reduction. Then accurately figure the weight of the line from the header to the turbine. Don't forget, that pipe covering has weight, too. I'd approach the problem of stresses by two methods. They won't agree completely, but they will be close enough to give you a check on your figures."

"Fine," said Mel. "What do I do then? Design a new hanger?"

"You can if you want to, but I think that you had better first find out what limit the turbine people put on that machine."

"Right," exclaimed Mel. "I'd forgotten that little detail."

Ask Advice on Correct Hanger

"Then hunt up a few catalogs. Call on one of the manufacturers of constant load hangers to supply you with the correct hanger for this particular job. Give them the data, and let them make the selection."

"Shift the load, Mel," laughed Dick.

"You bet I'll do just that," said Mel bruskly. "Maybe I'd better go back to school. Seems that there are certain things I overlooked when I was there."

Good Judgment Required

"Schools can give you a foundation of factual and theoretical knowledge, Mel, but only working in the plant can give you experience. There is a certain process by which experience is digested in the knowledge that we have. Out of this process, we develop judgment. Don't be discouraged if you don't get there all at once. Apply the knowledge that you have, Mel, thoughtfully and thoroughly, and you will have few experiences like this one."

"Check," declared Dick as they turned away from the engineer.

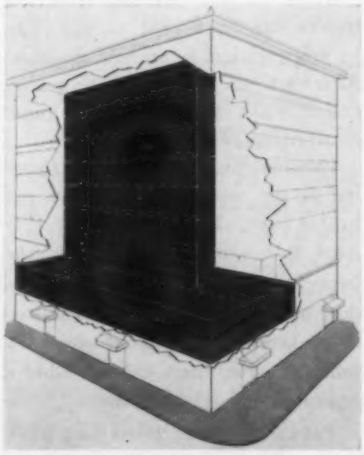
"Things are changing fast, Dick," said Mac. "Not only are gaskets being used less but far greater care must be used in everything we do in the steam plant. With rising pressures and temperatures and the demand for greater efficiency in all operations, we will have to rely more and more on the specialist who builds our equipment. It is not evading responsibility, but good common sense, to shift the load to those better qualified to carry it than we are."

Air Conditioning Yields 29 Percent Space Dividend

. . . for North Carolina bank

A NEW APPROACH to increasing available office building space through application of air conditioning has been found by a southern bank, according to the Carrier Corp. The state wide Wachovia Bank and Trust Co., the largest banking institution between Washington and Atlanta, has added 29 percent to the available floor space in its 44 year old, eight story home office building in Winston-Salem, N. C., by installing complete air conditioning. Gone is the need for earlier architectural methods of providing ventilation and some relief from the heat.

Bank officials had considered it necessary either to enlarge and modernize the present building, or to construct a new one. It was decided that by installing air conditioning to insure comfort, the two story high main banking area on the ground level could be cut horizontally, adding an entire new floor.



SPACE ADDED is indicated by the black area. New floor spaces are shown by the white dotted lines

Additional space has been gained by constructing floors at every level across a conventional light and ventilation court running from the second through the eighth story. The gain amounts to about 1000 sq ft per floor.

The air conditioning and refrigeration equipment takes up none of the reclaimed space. A centrifugal compressor in the modernized boiler room in the basement provides a cooling capacity of 220 tons. An equipment tower for the central air conditioning equipment has been constructed up the outside of the building in a set-back area no longer required for natural ventilation. Central system air conditioning units using chilled water will be located one to a floor in the tower, with each unit serving its entire floor of the building.

P. L. Davidson, consulting engineer of Greensboro, N. C. and Philadelphia, designed the installation, and the mechanical contractor is the Air Conditioning Corp. of Greensboro, N. C. and Winston-Salem, N. C.

SAM LEWIS' PAGE

What Is Air Conditioning Doing?

. . . in commerce, industry, and agriculture

THE IMPORTANCE of air conditioning in providing human comfort is beyond question today, so firmly has it become established in the mind of the public. Just as important, but not so widely known, is the role air conditioning has played, almost from its beginning, in industrial, commercial, and agricultural processes. Cotton milling, banana ripening, potato storing, and cranberry marketing are but a few examples of its diversified applications today.

• • •

Cotton fibers, pulled away from the seeds by the saw-teeth of the gin during warm dry weather, are baled and recompressed under tremendous pressure. A bale 3 ft thick is squeezed to one-third of its original size, and is then re-covered with netting and banded with steel. In the old days, inadequately restrained cotton bales on shipboard expanded sufficiently when wet to split the hull of the ship.

Cotton is used for many things besides thread, such as absorbent pads and filters. The proportion of moisture in the cotton is important, not only in the pounds for which the processor pays, but also in the cost of the treatment necessary to render the fibers amenable to each specialized process.

A bale of cotton therefore must be opened so that transfer of air and water vapor from and to the cotton shall have opportunity and time to stabilize. Experienced people in the industry suggest a heat insulated storage room of considerable size for opened cotton bales, with provision for the automatically controlled introduction of water vapor.

Because of the relatively tremendous total surface area of all the tiny filaments, the exchange of moisture requires many hours. If the cellulose — cotton — filaments are colder than the moisture laden air, they may condense some of the vapor to liquid water. We do not ordinarily desire drops of water in our cotton packed pads. If the walls of the unbaling room are cooler than the filaments, the latter may lose moisture to an undesirable extent, and too-dry cotton does not lend itself to pad making.

Green bananas arriving from the tropics are kept cold on the way by refrigeration, to prevent ripening. Afterward, they must still be refrigerated while the chemical changes of ripening continue.

Bananas give off heat while ripening at the rate of about 1 Btu per hr for every 2 lb of bananas. Perhaps this warming quality is the basis for the story of the fruit vendor, said to arrange for his children to be kept warm on cold nights by putting in each bed with the child a bunch of ripening bananas.

Potatoes also are interesting when one considers the Irish influence on American civilization. The flood of Irish immigration about 1840, when Ireland experienced a famine after successive years of failure of the potato crop, has greatly enriched American life. They helped build our railroads and canals and cities. The Irish profoundly influenced — and still do — our art, literature, science, and politics. And they taught us that potatoes are good food.

A million dollar plant just built in Chicago is devoted to the manufacture of potato chips. The potatoes, processed to salty chips, preferably are critically selected as to their native soil and temperature conditions, as well as to their ancestry. It is desirable to de-sugar them for several weeks in well-circulated and ventilated air, at a temperature of about 70 F, before processing them. Potatoes insist on being stored in the dark and are exclusive about sharing the compartment with fruits, nuts, eggs or dairy products, lest the potato flavor shall be transmitted objectionably.

I have a cranberry warehouse in northern Wisconsin. Cranberries are the seed carriers of apples and roses; that is, all three are of the Rosaceae family. We insulate and heat and cool the cranberries in warehouses, from harvest time in September until winter weather. Ultimately, they are moved in refrigerated and heated trucks to the retail outlets. Those berries, like the bananas, are very much alive while they ripen, and the warehouse aroma is that of apples. We must air condition them all the way from the vine to the pie.

• • •

Many other examples of process air conditioning could be cited, showing the dependence of our modern technological age upon air conditioning in various types of production. Necessary for each application is the correct design for controlling the temperature, humidity, and movement of the air for the desired results.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

ON THE JOB

New Hot Water System Cuts Laundry's Costs

. . . increases, maintains supply at 180 F

HOT WATER SUPPLY has been increased by over 40 percent without decreasing floor space and heating costs have been cut by $3700 per year, while maintaining 180 F on supply lines, at the Pierce Steam Laundry, Brooklyn, by the installation of new hot water heating equipment. The new equipment and hot water circulating system were installed without interrupting the plant operation. In addition, washing operations have been speeded up by 20 percent, according to The Patterson-Kelley Co., East Stroudsburg, Pa.

The plant manager and chief engineer decided to revamp the old system when capacity — 50,000 lb of laundry per week — increased the demand for hot water. At times, water was being used so fast that the temperature dropped to 110 F. At other times, the heating system could supply water to only four of 16 washwheels. Occasionally, rewashes were necessary. Frequent shutdowns to build up the water temperature meant that employees had to work overtime to catch up.

Laundry engineers called in to analyze the problem recommended the installation of the following:

1) An instantaneous hot water heater, 22½ x 20 x 126 in.

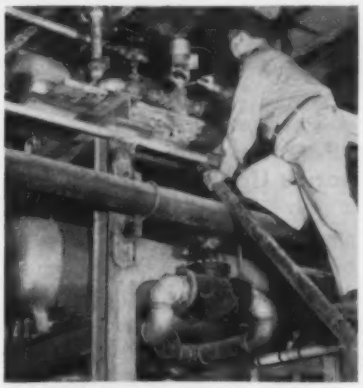
2) An instantaneous booster heater, 25 x 20 x 126 in.

3) A cement lined hot water accumulator tank, 84 x 240 in.

4) A closed type waste heat reclaimer, 43 x 37 x 17 ft, 6 in.

Now 142,000 to 159,000 gal of rust free hot water at a constant 180 F are supplied to the washwheels per 8 hr day. And pressure problems, maintenance headaches and costly shutdowns have been eliminated.

Additional savings include reduced consumption in fuel oil and steam. Pierce now uses about 10,000 gal per week of No. 6 fuel oil, or about 10 percent less than it formerly used.



THERMOSTATIC CONTROL cuts in the high pressure heat exchanger, part of the hot water system installed at the Pierce Steam Laundry in Brooklyn, which increased hot water supply by over 40 percent and cut heating costs $3700 per year

With more exhaust steam now than it needs, in the winter the plant utilizes the excess exhaust steam to heat the plant. With its improved hot water heating system, Pierce uses live steam to make hot water only during the first 20 minutes in the morning. Previously a 2 in. steam line at a pressure of 100 psig was needed, plus exhaust steam from both engines and other auxiliary equipment, to heat water all day.

Hot water from the washers at 130 F collects in a sump pit underneath the ground floor. It is pumped from here to the heat reclaimer, 10 ft off the ground floor. City water is fed to the reclaimer at a temperature of 60 F. Water leaves the heat reclaimer at 110 F and at a pressure of 50 psig.

It is then fed to the accumulator tank, 20 ft off the floor. Return water from the washroom at 170 F also enters the accumulator tank. Water leaves the accumulator at 130 F, and is driven by a 15 hp circulator pump into an instantaneous heater, then to an instantaneous booster heater, both 8 ft off the floor. Water leaves the booster heater at 180 F under a pressure of 70 psig and is piped to the 16 wash wheels.

Plastic Piping Installed Throughout Chemical Plant

. . . for corrosive services

PLASTIC PIPING for all services is being installed for the Globe Chemical Co., handlers of highly corrosive liquids. Globe, of Cincinnati, distributes acids, solvents and chemical compounds and has tank farms and loading facilities in several areas.

The new piping, of polyvinyl chloride, conveys mainly 77-96 percent sulfuric acid, 61.4 percent nitric acid, 37-38.5 percent muriatic acid, 75-85 percent phosphoric acid, and 99½ percent glacial acetic acid, according to Tube Turns Plastics, Inc. Temperatures are atmospheric, and pressures do not exceed 100 psi.

The piping ranges from 1¼ in. through 2 in. and is fabricated with unplasticized injection molded screwed fittings.

PVC PIPING is being installed for all services at the Globe Chemical Co. Here is a 2 in. intake line on a sulfuric acid storage tank

QUESTION OF THE MONTH

What Maintenance Program for Valves?

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

THE QUESTION, *What's the Basis of a Maintenance Program for Pressure Reducing Valves?*, was published previously in HPAC and is repeated here for information. Some answers were published previously. Here are some others that have been received. Other comments for publication will also be welcome.

"I am looking for information which might furnish a basis for an inspection, overhaul and replacement program covering 30 1 in. pipe size, pressure reducing valves, diaphragm operated, on cold water service. I would like to know how often to open the valves for inspection and about how often, on the average, it would be necessary to replace the diaphragms and the other working parts of the valves."

GEORGE B. ALLEN —

"Perform Valve Maintenance Upon Failure"

WE DO NOT BELIEVE that a definite procedure can be established for valve maintenance. The reason for this is that the life of the principal parts of a water reducing valve — the diaphragm and the valve disc — which incidentally are the only parts requiring replacement under ordinary conditions, is dependent entirely on the conditions of the installation. These are the initial pressure, reduced pressure and demand or load fluctuations. The life of these parts can be lengthened by the use of a pipe line strainer on the inlet side of the valve.

If I were a maintenance superintendent, in the interest of plant economy, I would authorize only the time required for examining water reducing valves when such an action was absolutely necessary as indicated by their failure to maintain the desired reduced pressure or the existence of a definite indication of a ruptured diaphragm.

Valves such as those manufactured by us have a small hole drilled in the spring case, which when emitting water indicates a ruptured diaphragm. A deteriorated valve disc can immediately be recognized by the failure of the valve to maintain the desired control pressure. In general, this is indicated by a "build-up" of the reduced pressure.

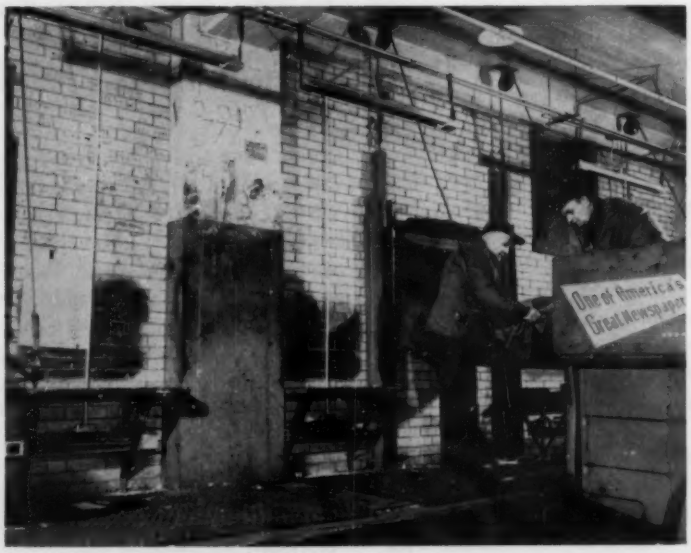
By carrying spare diaphragms and valve discs in stock, failures in operation can be corrected promptly. The

Radiant Heaters Serve Loading Platform

FAR-INFRARED RAYS from electric radiant heaters provide working comfort on the loading platform of the Pittsburgh Post Gazette, according to the Edwin L. Wiegand Co. The heaters combat icy blasts from the Monongahela river.

Five of the heaters are suspended above the working area and five are at leg level. All units are individually operated from a control panel at one end of the platform. A safety switch in the basement provides simultaneous shutoff of all heaters.

Says the building superintendent, "In the near zero and subzero weather of last winter, the heaters functioned well. We believe they will provide adequate protection from the complete exposure of our loading platform when the last building between it and the river is demolished."



THE LOADING PLATFORM of the Pittsburgh Post Gazette, which is exposed to icy river winds in winter, is comfortably heated for workmen by electric radiant heaters at two levels

only time required is for dismantling the valve and replacing the deteriorated parts.

In my opinion, it would be a waste of valuable time to set up a schedule whereby valves are periodically dismantled and examined for wear. Under normal conditions, the wearable parts have been known, in many instances, to last years before requiring replacement.—GEORGE B. ALLEN, Mason Neilan Regulator Co.

DAVID GOLNER —

"Valve Packing Determines Maintenance"

THE QUESTION can only be answered in a generalized manner since the basis for an inspection, overhaul and replacement program covering diaphragm operated valves depends upon many factors. Diaphragm control valves are used over a wide range of pressures and pressure drops on cold water service and the criterion for replacement of parts generally depends upon the type of packing originally supplied in the valves as well as the pressure drop being controlled by the valve.

If standard graphite asbestos packing is used in the valve, then we would suggest the packing be replaced approximately once a year. However, the packing box should be lubricated at least once every 30 days. If teflon packing is used in the valve, then we do not anticipate that any maintenance would be required for the packing box. The replacement of valve trim depends upon the trim materials and erosion caused by the pressure drop of the valve.

On cold water service with a pressure drop under 30 psi, we would expect the life of the trim to be almost indefinite if the trim is stainless steel. If other trim is used, we might anticipate that trim would have to be replaced about once every five years. The life of the valve diaphragm generally depends upon the ambient conditions and the frequency of valve operation under which the valve is used. Diaphragms normally are replaced approximately once every three to five years. — DAVID GOLNER, Hammel-Dahl Co.

J. G. JONES —

"Valves Should Not Be Disturbed If Working"

IN ESTABLISHING a maintenance program, consideration should first be given to the additional question, "Are the valves in continuous service, or are there shutdown periods such as might be connected with seasonal work?"

If the valves are in continuous service, they should not be disturbed unless they fail to function properly. A reliable valve may work for as long as 10 years or more without maintenance if the water which is controlled by the valves is clean and reasonably free from corrosive or other deteriorating materials. However, if it is removed from the line and inspected internally, parts may have to be replaced that otherwise would have given considerably longer service had they not been disturbed. It would be better to carry spare parts and make repairs only when required.

For 30 valves, about 10 replacement diaphragms and seat discs should be stocked. It would also be advisable to have a half dozen renewal units and two complete replacement valves.

If the valves go through a period of idleness, the program should be set up differently. Dependable performance will be required when operations start, and valves, like machinery, sometimes receive harmful effects from periods of inactivity. So, under these conditions, plans should be made to spot check them during the shutdown period. In this manner, their general condition may be determined and plans made to perform maintenance work on all of the valves accordingly. — J. G. JONES, Vice President and General Manager, A. W. Cash Co.

SYLVAN L. HANAUER —

"I Have Found a Solution, with Help"

SINCE I ASKED this question originally, I want to express my appreciation to those that have contributed answers to my question here and in the February and March HPAC's. These answers have pointed out to me the important considerations that are involved. As a result, I have been able to crystallize a solution.

Because of special local conditions, my client wanted a firmly defined maintenance schedule, at least to start off. Based upon your help and that of the manufacturers of reducing valves and diaphragm material, I have recommended the following, subject to modification as further experience will indicate.

1) Inspection and cleaning of strainers every three months.

2) Inspection of valve seats every year.

3) Inspection of diaphragms every three years.

It is contemplated that after several years' experience each of the above mentioned intervals will be doubled. — SYLVAN L. HANAUER, Consulting Engineer.

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

READER ASKS —

"How To Size Piping for Steam Unit Heaters?"

"Where can I find specific information on pipe sizing for unit heaters, especially return pipe sizes when a condensation return pump is used?

"What pressure drop should be used when the unit heaters are selected on the basis of a steam pressure of 2 psig, and on the basis of a steam pressure of 5 psig?

"Can any reduction in return pipe sizes be made because a condensation return pump is used?"—C.R.W.

THE LAW AND YOUR PROFITS

By William Hurd Hillyer

Have No Hazy Understandings

. . . It's risky to proceed without a written contract

● When is payment due on a heating, piping, and air conditioning job where no specific date is mentioned?

● Work having been started, how is the contractor affected by the client's refusal to sign a written contract when the tendered contract differs materially from a previous oral agreement?

● What is the yardstick of recovery for the client's breach of verbal contract in such circumstances?

ANSWERS to these questions are implicit in a recent case, which also serves to spotlight the hazard of hazy understandings. [All names herein are fictitious.]

Mrs. Fee Holda arranged with De Warum & Co. to install a heating and air conditioning system in the new building she was erecting on long lease for a mail order firm. The agreement, though verbal, was clear-cut and at a definite price.

De Warum proceeded to purchase the necessary machinery and equipment on Mrs. Holda's order, as set forth in her written plans and specifications. With accommodating though questionable haste, he installed cement-asbestos flue pipes and supports on the premises, even before the first concrete slab had been poured for the building. However, he requested further instructions.

Then he presented a formal contract in writing. This the lady refused to sign. Furthermore, De Warum contended, she repudiated her oral agreement and forbade the heating and air conditioning contractor to go ahead with the work. In due course, he sued Mrs. Fee Holda for the $4089 alleged profit he would have made if he had been allowed to go ahead.

In civil court, Mrs. Holda denied owing anything to the heating and air conditioning firm. She also denied the existence of a contract. As for De Warum's contention that Mrs. Holda repudiated her agreement, her agent maintained that De Warum "withdrew his proposal" by telephone, "which withdrawal was accepted, and that all negotiations were canceled." The trial jury found for the contractor, the sum of $3112. From this judgment Mrs. Holda appealed.

The court of appeals prefaced its decision with a "syllabus," or legal statement, in substance as follows:

1) When a contract is entered into and the contract price is agreed upon, but the time of payment is not fixed, the law implies that payment of the agreed price will be made upon completion of the contract.

2) Where a verbal contract has been made, one party's subsequent refusal to sign a written contract — even though it varies from the original set-up — is immaterial and does not invalidate the original agreement.

3) If a real estate owner renounces an agreement pursuant to which a contractor has undertaken to improve the property, the contractor is entitled to recover the difference between the contract price and the cost of labor and materials, should the work not have been finished. In the course of proving such cost, evidence is necessarily restricted to a reasonable sum, the court emphasized.

Foiled, Mrs. Holda asked, in effect, what constituted "reasonable" cost, and whether the jury had the right to return a verdict for less than the sum named in the suit. The appeals court held that the nature of testimony "seeking to show the cost of labor and material" is "opinative" and that "the question of the value of an article is peculiarly for the jury." The verdict of a sum less than that sued for was authorized under the evidence, ruled the higher tribunal, sustaining the civil court's judgment in favor of the contractor.

Mr. De Warum, despite the principles of law working for his protection, ran a considerable risk. The appeals court pointed out that the evidence would have justified the civil court jury in finding that no oral contract had ever been entered into for the heating or air conditioning of the building. In addition, the jury might with equal propriety have found that De Warum made certain bids, withdrew them, and later submitted a written contract which was rejected by Mrs. Holda.

Such findings, in the appeals court's opinion, might just as well have been reached by the jury under the evidence as those which gave De Warum the verdict.

The appeals justices would almost certainly have let a verdict against the contractor stand, considering their expressed views as to the evidence. The contractor would then have lost the sum involved as a penalty for his excessive zeal to get started without a written contract.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

What Does Air Conditioning Cost?

. . . per square foot in office buildings, for operation and amortization?

AMORTIZATION and operating costs are among the key figures in computing the profitability of air conditioning as an investment and in terms of its operating efficiency and economy. This is true whether the installation is a central system, packaged unit, or room cooler type.

Net costs in cents per square foot per year, including power consumption, labor, material, repairs, interest, and amortization, are given for office buildings in the accompanying tables. The tables are based upon an average of 250 sq ft of rentable office space per ton of refrigeration.

For example, if the estimated purchase price is $1000 per ton, and the estimated operating cost is $40 per ton per year, and the owner wishes to write off the investment in 10 years at 5 percent, the net rental increase per sq ft of rental area required is $0.68.

The tables are from *Air Conditioning Guide for Office Buildings*, prepared by The Electrical Association and the Building Owners' and Managers' Association, both of Philadelphia. Harry L. Baker, Jr., Associate Company Engineer of the Penn Mutual Life Insurance Co., developed the data in the tables. Copies of the booklet may be obtained for $1.00 from the Building Owners' and Managers' Association, 1604 Lincoln-Liberty Bldg., Philadelphia 7.

AMORTIZATION & OPERATING COSTS FOR AIR-CONDITIONING
(In Cents/Sq. Ft./Year)

INSTALLATION COSTS DOLLARS/TON	OPERATING COSTS DOLLARS/TON/YEAR	PERIOD OF AMORTIZATION AND INTEREST RATE															
		5 YEAR PERIOD				10 YEAR PERIOD				15 YEAR PERIOD				20 YEAR PERIOD			
		3½%	4%	4½%	5%	3½%	4%	4½%	5%	3½%	4%	4½%	5%	3½%	4%	4½%	5%
600	25	63	64	65	65	39	40	40	41	31	32	32	33	27	28	28	29
	30	65	66	67	67	41	42	42	43	33	34	34	35	29	30	30	31
	35	67	68	69	69	43	44	44	45	35	36	36	37	31	32	32	33
	40	69	70	71	71	45	46	46	47	37	38	38	39	33	34	34	35
	45	71	72	73	73	47	48	48	49	39	40	40	41	35	36	36	37
	50	73	74	75	75	49	50	50	51	41	42	42	43	37	38	38	39
700	25	72	73	74	75	44	45	45	46	34	35	36	37	30	31	32	32
	30	74	75	76	77	46	47	47	48	36	37	38	39	32	33	34	34
	35	76	77	78	79	48	49	49	50	38	39	40	41	34	35	36	36
	40	78	79	80	81	50	51	51	52	40	41	42	43	36	37	38	38
	45	80	81	82	83	52	53	53	54	42	43	44	45	38	39	40	40
	50	82	83	84	85	54	55	55	56	44	45	46	47	40	41	42	42
800	25	81	82	83	84	48	49	50	51	38	39	40	41	33	34	35	36
	30	83	84	85	86	50	51	52	53	40	41	42	43	35	36	37	38
	35	85	86	87	88	52	53	54	55	42	43	44	45	37	38	39	40
	40	87	88	89	90	54	55	56	57	44	45	46	47	39	40	41	42
	45	89	90	91	92	56	57	58	59	46	47	48	49	41	42	43	44
	50	91	92	93	94	58	59	60	61	48	49	50	51	43	44	45	46
900	25	90	91	92	93	53	54	55	57	41	42	44	45	35	36	38	39
	30	92	93	94	95	55	56	57	59	43	44	46	47	37	38	40	41
	35	94	95	96	97	57	58	59	61	45	46	48	49	39	40	42	43
	40	96	97	98	99	59	60	61	63	47	48	50	51	41	42	44	45
	45	98	99	100	101	61	62	63	65	49	50	52	53	43	44	46	47
	50	100	101	102	103	63	64	65	67	51	52	54	55	45	46	48	49
1000	25	99	100	101	102	58	59	61	62	45	46	47	49	38	39	41	42
	30	101	102	103	104	60	61	63	64	47	48	49	51	40	41	43	44
	35	103	104	105	106	62	63	65	66	49	50	51	53	42	43	45	46
	40	105	106	107	108	64	65	67	68	51	52	53	55	44	45	47	48
	45	107	108	109	110	66	67	69	70	53	54	55	57	46	47	49	50
	50	109	110	111	112	68	69	71	72	55	56	57	59	48	49	51	52

AMORTIZATION AND OPERATING COSTS FOR AIR CONDITIONING (Continued)

(In Cents/Sq Ft/Year)

INSTALLATION COSTS DOLLARS/TON	OPERATING COSTS DOLLARS/TON/YEAR	PERIOD OF AMORTIZATION AND INTEREST RATE															
		10 YEAR PERIOD				15 YEAR PERIOD				20 YEAR PERIOD				25 YEAR PERIOD			
		3½%	4%	4½%	5%	3½%	4%	4½%	5%	3½%	4%	4½%	5%	3½%	4%	4½%	5%
1100	30	65	66	68	69	50	52	53	54	43	44	46	47	39	40	42	43
	35	67	68	70	71	52	54	55	56	45	46	48	49	41	42	44	45
	40	69	70	72	73	54	56	57	58	47	48	50	51	43	44	46	47
	45	71	72	74	75	56	58	59	60	49	50	52	53	45	46	48	49
	50	73	74	76	77	58	60	61	62	51	52	54	55	47	48	50	51
	55	75	76	78	79	60	62	63	64	53	54	56	57	49	50	52	53
1200	30	70	71	73	74	54	55	57	58	46	47	49	51	41	43	44	46
	35	72	73	75	76	56	57	59	60	48	49	51	53	43	45	46	48
	40	74	75	77	78	58	59	61	62	50	51	53	55	45	47	48	50
	45	76	77	79	80	60	61	63	64	52	53	55	57	47	49	50	52
	50	78	79	81	82	62	63	65	66	54	55	57	59	49	51	52	54
	55	80	81	83	84	64	65	67	68	56	57	59	61	51	53	54	56
1300	40	79	80	82	83	61	63	64	66	53	54	56	58	48	49	51	53
	45	81	82	84	85	63	65	66	68	55	56	58	60	50	51	53	55
	50	83	84	86	87	65	67	68	70	57	58	60	62	52	53	55	57
	55	85	86	88	89	67	69	70	72	59	60	62	64	54	55	57	59
	60	87	88	90	91	69	71	72	74	61	62	64	66	56	57	59	61
	65	89	90	92	93	71	73	74	76	63	64	66	68	58	59	61	63
1400	40	83	85	87	89	65	66	68	70	55	57	59	61	50	52	54	56
	45	85	87	89	91	67	68	70	72	57	59	61	63	52	54	56	58
	50	87	89	91	93	69	70	72	74	59	61	63	65	54	56	58	60
	55	89	91	93	95	71	72	74	76	61	63	65	67	56	58	60	62
	60	91	93	95	97	73	74	76	78	63	65	67	69	58	60	62	64
	65	93	95	97	99	75	76	78	80	65	67	69	71	60	62	64	66
1500	40	88	90	92	94	68	70	72	74	58	60	62	64	52	54	56	59
	45	90	92	94	96	70	72	74	76	60	62	64	66	54	56	58	61
	50	92	94	96	98	72	74	76	78	62	64	66	68	56	58	60	63
	55	94	96	98	100	74	76	78	80	64	66	68	70	58	60	62	65
	60	96	98	100	102	76	78	80	82	66	68	70	72	60	62	64	67
	65	98	100	102	104	78	80	82	84	68	70	72	74	62	64	66	69
1600	40	93	95	97	99	72	74	76	78	61	63	65	67	55	57	59	61
	45	95	97	99	101	74	76	78	80	63	65	67	69	57	59	61	63
	50	97	99	101	103	76	78	80	82	65	67	69	71	59	61	63	65
	55	99	101	103	105	78	80	82	84	67	69	71	73	61	63	65	67
	60	101	103	105	107	80	82	84	86	69	71	73	75	63	65	67	69
	65	103	105	107	109	82	84	86	88	71	73	75	77	65	67	69	71

HEATING, PIPING & AIR CONDITIONING

AMERICAN SOCIETY OF
HEATING AND AIR-CONDITIONING ENGINEERS

Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Sources of Vent Gas in a Hot Water Heating System†

By L. N. Montgomery*, Boston, Mass., and W. S. Harris **, Urbana, Ill.

SUMMARY — It is a recognized fact that gases continue to accumulate in hot water heating systems even though the systems have been in operation for years. This paper contains a discussion of tests made to determine the nature of and the sources of these gases in a closed hot water heating system having an air cushion tank just above the boiler. It was found that the main source of vent gas was nitrogen which was transferred from the air cushion tank. Metal corrosion which evolved hydrogen gas in small quantities was a secondary and continuing source. Temporary sources were gas dissolved in the make-up water or evolved from the breakdown of dissolved solids.

IT IS a recognized fact that gases continue to accumulate in hot water heating systems even though the systems have been in operation for years. While industry has developed automatic air vent valves and other devices intended to reduce the necessity of periodic manual venting of the gas, there has been little study of the possible sources of this gas.

It was observed during the course of the regular research work at the I=B=R Research Home that it was necessary to vent the room heating units on a regular schedule to prevent air binding. Furthermore, it was noted that the most gas collected in the room heating units on the second story which were connected to the main near the boiler supply connection, and lesser amounts collected in the other second story units and the first story units near the boiler. Only traces of gas were ever vented from the other radiators in the system. This observation and previous work by others suggested that the mechanism of vent gas accumulation and its release was suited to experimental analysis.

Description of Equipment

The Research Home, shown in Fig. 1, was a two-story dwelling designed and furnished to represent a well-built American home. It was equipped with instruments to measure operating conditions of the heating system and temperatures produced and for recording room air and boiler water temperatures. Thermocouples were provided for measurement of air temperatures throughout the house, and for measurement of water temperature at various points in the heating system. An elbow meter[1] was provided for measuring water flow rates in the system.

The same heating system was in continuous use during the time covered by this report. It was a one-pipe, forced-circulation hot water system, designed in accordance with I=B=R Installation Guide No. 100. The supply and return trunks were 1-in. iron pipe, and ¾-in. pipe was used for the mains in the north and

†This paper is a digest of a thesis submitted by the senior author in partial requirement for the degree of Master of Science in Mechanical Engineering in the Graduate College of the University of Illinois.

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[1]The Use of an Elbow in a Pipe Line for Determining the Rate of Flow in a Pipe (University of Illinois, *Engineering Experiment Station Bulletin* 289, 1936).

south loops. All branch piping was ½-in. A diagram of the piping layout is shown in Fig. 2. A design water temperature of 215 F was used to determine the amount of radiation installed in each room.

The only changes made to the heating system as a part of this investigative program were made during the summer of 1952. At that time, an 18 gal air cushion tank was substituted for the 24 gal tank in use during the 1951-52 heating season. At the same time, the point at which the air cushion tank was connected to the heating system was changed from the angle flow control valve above the boiler to a special dip-tube boiler fitting.

The three-section, cast-iron boiler was fired by a single-port gas conversion burner using natural gas with a heating value of 1000 Btu per cu ft. The firing rate was maintained at 100 cu ft per hr, and the carbon dioxide content of the flue gas was held at 8 percent. Under these conditions the measured gross boiler output was 66,000 Btu per hr.

A diagram of the control circuit is shown in Fig. 3. The high limit control in the boiler stopped the burner at boiler water temperature of 235 F, but allowed the circulator to continue operating. The low limit control in the boiler was set to maintain the boiler water temperature above 165 F when the circulator was not operating. It was disconnected during some special tests.

Fig. 1—I=B=R Research Home

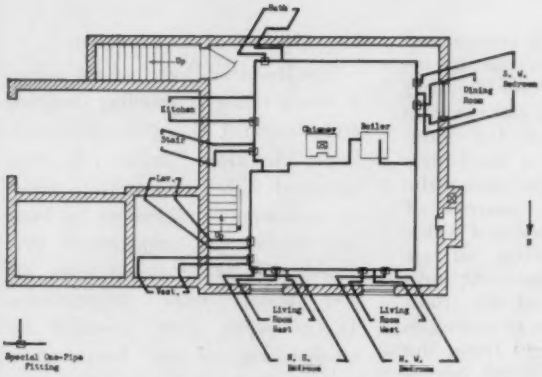

Fig. 2—Diagram of Heating System Piping

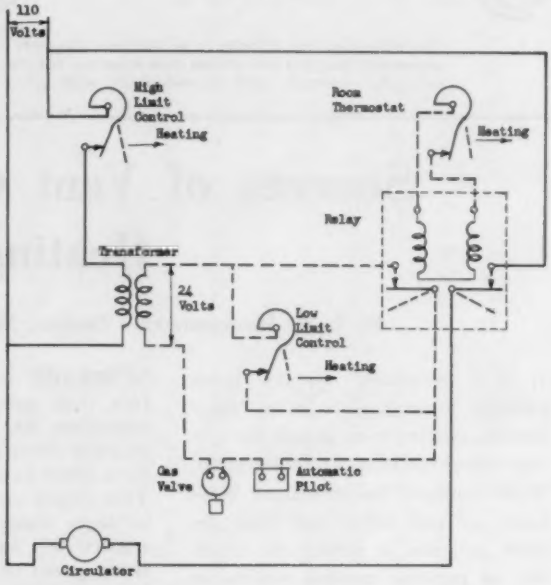

Fig. 3—Diagram of Control System

enter the system as dissolved gas in the fill water.

A representative sample of gas vented from the system approximately 40 days after filling the system with tap water had the analysis shown in Table 1.

It was considered that the source of the carbon dioxide might be either dissolved gas in the fill water or dissolved bicarbonates which were being broken down into carbonates, gas and water. Some methane was known to be dissolved in the tap water used to fill the system, and it was assumed that this source accounted for all of the methane present. The hydrogen was probably released in a gas-evolving corrosion reaction which would dissolve iron in the process. The quantity of nitrogen, however, was too great to assume that it was dissolved in the water used for filling the system. It was evident that there must be a continuing source of this gas.

Analysis of Vent Gases

A preliminary study of possible vent gas sources indicated that gases might be transferred from the air cushion tank by solution and later released from the water in the system; that they might be evolved from chemical reactions occurring in the system; and that they might

Air Cushion Tank As a Vent Gas Source

The air trapped in the air cushion tank was a likely source of the nitrogen and oxygen observed in the vent gases. This air is intended to provide a relief for thermal expansion as the water in the main part of the system is alternately heated

and cooled. Thus, water from the system enters the tank compressing the air slightly during the time the burner is in operation. The water in the air cushion tank was essentially at room temperature, and remained so because the mass of hot water transferred by expansion was small compared to the volume of the water already in the tank. Since gases are more readily soluble in cold water than in hot, some of the air in the tank was taken into solution by the water. As the system cooled some water containing

Table 1—Composition of Gases Vented From Conventional Hot Water System

Extracted Gas		Composition Percent By Vol.
Carbon Dioxide	CO_2	1.1
Hydrogen	H_2	12.8
Methane	CH_4	2.2
Nitrogen	N_2	83.0
Oxygen	O_2	0.9
		100.0

Table 2—Composition of Vent Gas When Operating with Rubber Bulb in Air Cushion Tank

Extracted Gas		Composition Percent	
		First Test	Second Test
Carbon Dioxide	CO_2	1.3	0.5
Hydrogen	H_2	71.9	71.9
Methane	CH_4	2.0	9.8
Nitrogen	N_2	23.3	16.0
Oxygen	O_2	1.5	1.8
		100.0	100.0

Fig. 4—Rubber Bulb in Air Cushion Tank

Fig. 5—Air Cushion Tank

dissolved air left and went back to the system. This process gradually increased the concentration of dissolved gas in the entire heating system until eventually the saturation point was reached at some point during periods of each heating cycle. Gases were then released in the system piping, the boiler or room units and carried through the system as bubbles to collect at high points.

An air tight rubber bulb, Fig. 4, was inserted in the tank through the fitting shown in Fig. 5. After insertion, the bulb was inflated to slightly above atmospheric pressure and the remaining space inside the tank was completely filled with water by venting all free air as the tank was filled. An air cushion was thus provided, but with no direct contact of air and water.

After the system had operated for two weeks the rate of gas release was measured and a sample taken for analysis. The rate of gas release when operating with no direct contact of air and water in the air cushion tank was reduced to roughly one-quarter of the rate obtained when operating with free contact between the water and the air. Table 2 shows the vent gas analysis for two successive bi-weekly tests.

The actual rate of release of hydrogen and methane in these tests had not changed to any marked degree from the rate of release before the rubber bulb was inserted in the air cushion tank. The reason for the percentage increase of hydrogen and methane reported in Table 2 as compared with Table 1 was that the total rate of release of nitrogen and oxygen had decreased sharply. The small amounts of nitrogen and oxygen which were observed were probably already in solution in the water of the system at the time the rubber bulb was installed in the air cushion tank. These tests verified the belief that nitrogen and oxygen were transmitted from the air cushion tank when there was an interface between the air and water in the tank.

Chemical Reactions As a Source of Vent Gases

Corrosion Processes: Both the hydrogen and the carbon dioxide which were reported in the gas analyses in Tables 1 and 2 were considered to be evolved by chemical reactions. The source of the hydrogen was assumed to be a corrosion reaction which dissolved iron in the water as ferrous hydroxide and released hydrogen at the iron surface. According to Speller[2] when an iron surface is exposed to water, the iron atoms and hydrogen ions formed in dissociation of water molecules will react to form ferrous ions and hydrogen atoms.

$$\underset{\text{Metal}}{Fe} + \underset{\text{Ions}}{2H^+} \rightleftharpoons \underset{\text{Ion}}{Fe^{++}} + \underset{\text{Atoms}}{2H} \qquad \text{(1)}$$

The ferrous ions will go into solution to replace the hydrogen ions and the hydrogen atoms will *plate out* or form a thin film on the exposed surface. Before the reaction can proceed any further, the hydrogen atoms must be removed. This can be accomplished by destruction of the film.

$$\underset{\text{Atoms}}{2H} + \underset{\text{Dissolved}}{\tfrac{1}{2}O_2} \longrightarrow \underset{\text{Liquid}}{H_2O} \qquad \text{(2a)}$$

or its removal as bubbles of gas

$$\underset{\text{Atoms}}{2H} \longrightarrow \underset{\text{Gas}}{H_2} \qquad \text{(2b)}$$

For the case being considered, part of the ferrous ions from Reaction 1 remained in solution as ferrous hydroxide

$$Fe^{++} + 2OH^- \rightleftharpoons Fe(OH)_2 \qquad \text{(3)}$$

[2] *Corrosion, Causes and Prevention*, by F. N. Speller, (McGraw-Hill Book Co., Inc., New York, N. Y., 1951, p. 13-16.)

and the remainder was deposited as a soft, black magnetic coating over the waterside of the system.

Whether Reaction 2*a* or 2*b* was predominant depended upon the acidity of the water and the amount of free oxygen present. From earlier tests it was determined that gas was taken into solution by the water in the air cushion tank and then distributed to all parts of the heating system. A material balance would be required to determine how much oxygen was so dissolved and what portion of this may have been used by Reaction 2*a*.

During the 1952-53 heating season, the heating system was filled with fresh water at the start of the winter, and the same water was used throughout the rest of the season.

The pH of the water used to fill the system initially was 7.60. Within two weeks, however, it rose to 8.0 and remained between 8.0 and 8.1 for the rest of the season. These pH values indicate the water in the system was at all times neutral or slightly alkaline, a condition not favorable for the occurrence of Reaction 2*b*.

The material balance, also made during the winter of 1952-53, was started about one week after the system had been refilled following alterations. The quantity of air lost from the air cushion during normal operation of the heating system was determined by the change in water level of a gage glass on the air cushion tank and was compared with the quantity of gas vented from the system.

Over a period of 29 days, a total of 218 cu in. of gas was vented from the system. In the same interval the water level in the tank rose 21/32 in., indicating the loss of about 447 cu in. of free air from the tank. The difference between the gas vented and the gas lost from the tank was (447 − 218) or 229 cu in. All pipe joints had been sealed and checked for leaks and precautions were taken to insure as nearly as possible the same amount of gas in solution in the system water at the beginning and end of the test. This indicated a loss of gas in some manner other than venting.

No sample of the air in the air cushion tank was taken at the start of this test, but there is no reason to doubt that it consisted of oxygen and nitrogen in about the same ratio as found in the atmosphere. This being true, the percentage composition of the gas in the air cushion tank at the start of the test was as shown in Table 3, Column 2. The percentage composition at the end of the 29-day test was determined by chemical analysis and is shown in Column 4. The percentage composition and the quantities of gases vented from the system during the 29-day test are shown in Columns 7 and 8, respectively. If it is assumed the water in the systems was saturated with nitrogen at the start and end of the test, then the quantity of nitrogen in the vent gases must equal the quantity of nitrogen absorbed by the water in the air cushion tank, or

$$0.79x - 0.926y = 212 \text{ cu. in.} \quad (4)$$

where

x = free volume of gas in air cushion tank at start of test in cubic inches.

y = free volume of gas in air cushion tank at end of test in cubic inches.

Also, the change in water level in the air cushion tank indicated that

$$x - y = 447 \text{ cu. in.} \quad (5)$$

Simultaneous solution of these equations yields a value of 1484 cu in. for x and 1037 cu in. for y. Having determined the values of x and y, the remaining values in Columns 3 and 5 of Table 3 were obtained using the corresponding percentage values in Columns 2 and 4. The oxygen which apparently combined with hydrogen was (240 − 4) = 236 cu in. This figure checked closely with the difference in the volumes of gas lost from the air cushion tank and that vented from the system (447−218=229 cu in.).

Knowing the quantities of oxygen which combined with hydrogen and free hydrogen remaining, Reactions 1, 2*a*, and 2*b* may be used to estimate the rate of corrosion in the system. Reaction 2*a* states that one volume of oxygen will combine with two volumes of hydrogen gas. Two hundred thirty six cu in. of oxygen were consumed by this reaction requiring 472 cu in., or 0.02269 oz of hydrogen. Reaction 1 states that the ionization of one atom of iron to the ferrous state will release 2 atoms of hydrogen. The atomic weights of iron and hydrogen are 55.8 and 1.0, respectively. Therefore, the 0.02269 oz of hydrogen entering into Reaction 2*a* represented the ionization of 0.02269 × 55.8/2 = 0.6330 oz of iron. The 0.7 cu in. (0.00003147 oz) of hydrogen formed by Reaction 2*b* represents the ionization of 0.0009 oz of iron. Over the 29-day test period a total of 0.6330 + 0.0009 = 0.6339 oz of iron were dissolved. Thus it appears that the rate of iron corrosion in the system was only a few ounces per year.

Water velocities in the system were fast enough to insure a uniform loss of metal with no pitting of the pipe walls; therefore, the rate of corrosion indicated by the evolution of small amounts of hydrogen should be no cause for alarm. It should be

Table 3—Material Balance Summary

		Air Cushion Tank					Vented Gas	
		Start		End				
		Composition, percent by volume	Volume, cu in.	Composition, percent by volume	Volume, cu in.	Difference in volume, cu in., Col. 3 — Col. 5	Composition, percent by volume	Volume, cu in.
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Carbon Dioxide	CO_2			0.5	5	−5	0.5	1.1
Oxygen	O_2	21.0	312	6.9	72	240	1.9	4.2
Nitrogen	N_2	79.0	1172	92.6	960	212	97.3	212.0
Hydrogen	H_2						0.3	0.7
			x = 1484		y = 1037	447		218.0

noted that the release of hydrogen gas in very small amounts will not cease, but will be a continuing process in any system. The very small extent to which even neutral water is ionized is sufficient to allow Reaction 2*b* to proceed at a slow rate.

While the generation of hydrogen by Reaction 2*b* was of interest, it was not and is not normally the method by which really destructive corrosion occurs. Reaction 2*a* is generally the most active and is dependent upon dissolved oxygen for completion. It has been found that the rate of metal corrosion in neutral or slightly alkaline solutions is directly proportional to the concentration of dissolved oxygen. Therefore, corrosion will not be a problem in hot water heating systems so long as the concentration of dissolved oxygen in the water is maintained at a low level, and the water is maintained neutral to slightly alkaline.

Breakdown of Dissolved Solids as a Source of Vent Gas: When the heating system was being filled at the start of the 1952-53 heating season, a sample of the fill water was taken for partial analysis with the following results:

Test	Reported as	ppm
Iron (total)	Fe	0
Alkalinity (P)	$CaCO_3$	0
Alkalinity (M)	$CaCO_3$	304
pH		7.60

Within two weeks after the system was put into operation the pH of the system rose to 8.0 and remained betwen 8.0 and 8.1 for the rest of the second season.

At the end of the season, another partial analysis was made with the following results:

Test	Reported as	ppm
Iron	Fe	0.9
Alkalinity (P)	$CaCO_3$	2
Alkalinity (M)	$CaCO_3$	64

The water supply for the twin cities of Champaign-Urbana comes from local wells, and it contains a large amount of calcium bicarbonate in solution compared to the calcium carbonate present. This is indicated by the relation between the phenolphtalein (P) alkalinity test, which gives a measure of the carbonates present and the methyl orange (M) test which gives a measure of the bicarbonates. All of the alkalinity in the fill water was due to bicarbonates which impart a *temporary* hardness to the water. Upon heating, these bicarbonates decompose to release water, carbon dioxide, and calcium carbonate, some of which is precipitated. The equation for this process is:

$$Ca(HCO_3)_2 + \text{heat} = \underset{\text{liquid}}{H_2O} + \underset{\text{gas}}{CO_2} + \underset{\text{precipitate}}{CaCO_3} \quad \ldots\ldots(6)$$

Equation 6 was the source of carbon dioxide observed in vent gases.

Not all of the calcium carbonate which was released in the breakdown of bicarbonates in the system was precipitated. Some of the carbonate remained in solution, as evidenced by the P alkalinity at the end of the season. Where P is less than ½ M, carbonates in solution are calculated to be 2 P, or, in this case 4 ppm. Bicarbonates accounted for the remainder of the M alkalinity; hence, bicarbonates present were (64 − 4) = 60 ppm. The value of 60 ppm was less than one-fifth the amount of dissolved bicarbonates present at the beginning of the season.

Carbonates in solution hydrolyze to form acid ions to a lesser degree than bicarbonates, and if other conditions of the water which affect pH remained the same, breakdown of the bicarbonates to carbonates offers a satisfactory explanation for the observed increase in pH.[3]

The amount of iron present in the water at the end of the heating season was not enough to affect the turbidity of the water, and was probably present as ferrous hydroxide.

Fill Water As a Direct Source of Vent Gas

The water used to fill the heating system was a direct source of vent gas, since measurable quantities of oxygen, nitrogen, and methane were dissolved in the tap water. The total water content of the system used during the 1952-53 heating season was 28 gal, including the water in the air cushion tank. When this water entered the system, it contained approximately 0.8 parts per thousand (ppt), or 5 cu in., of methane, 12.5 ppt, or 81 cu in., of nitrogen, and 25 ppt, or 162 cu in., of oxygen. Since there was no source of methane other than the fill water, it served as a *tracer*, and its disappearance indicated that the gas dissolved in fill water had been completely vented.

Analyses of the vent gas were made at intervals during the heating season, and traces of methane were still observed four months after beginning operation. However, the analysis after six months of operation showed no trace of methane, indicating that the fill water was only a temporary source of vent gas.

[3] *Corrosion Causes and Prevention*, by F. N. Speller (McGraw-Hill Book Co., Inc., New York, N.Y., p. 384).

Conclusions

1. The main source of vent gas in a hot water heating system is nitrogen which is transferred from the air cushion tank. Metal corrosion which evolves hydrogen gas in small quantities is a secondary and continuing source. Temporary sources are gas dissolved in the make-up water or evolved from the breakdown of dissolved solids.

2. Oxygen in the make-up water and in the air cushion tank will combine chemically in a corrosion reaction, resulting in a drop in the static head of a closed system. This corrosion reaction is minor from the standpoint of metal consumed.

Acknowledgment

Experimental work to determine the sources of vent gas in a hot water heating system was performed at the I=B=R Research Home during the winters of 1951-52 and 1952-53. The authors wish to acknowledge the assistance of Dr. T. E. Larson and R. M. King, head of the Chemistry Subdivision and assistant chemist, respectively, of the Illinois State Water Survey. These men acted in an advisory capacity and assisted in gas and water analyses. Acknowledgment is also made to those manufacturers who supplied the equipment used.

THE PRESIDENT'S PAGE

Membership Grades

ABOUT three years ago the Engineers' Council for Professional Development recommended that all of the engineering societies change their membership grade names and qualifications so that corresponding grades would be approximately the same.

Several engineering societies have already done this and your Council is now proposing that our By-Laws be changed so that we may also meet these recommendations.

These proposed By-Laws changes are scheduled for presentation to the membership at the Semi-Annual Meeting in San Francisco in June, and a vote will be taken at the 62nd Annual Meeting in Cincinnati next January.

The proposed changes provide that the grades of membership in the Society shall be: Honorary Members, Presidential Members, Life Members, Fellows, Members, Associate Members, Affiliates, and Students.

This change would eliminate the present grade of Junior and add the grade of Fellow.

The Associate Member grade would include any person having been graduated from a college or school of engineering with an engineering curriculum accredited by the ECPD, or from a foreign engineering school maintaining similar standards, or from an engineering school of collegiate grade approved by the Council, or possessing eight (8) years of experience satisfactory to the Council in the arts relating to the sciences of heating, ventilating, cooling or air conditioning, or the allied arts and sciences.

Present Junior Members would be transferred to the Associate Member grade and present Associate Members would continue. The dues of an Associate Member under thirty (30) years of age would be $15.00 per year, and he would not have the privilege of voting. At the age of thirty (30) an Associate Member would have the privilege of voting and his dues would be increased to $25.00 per year.

The grade of Fellow would have an honorary status to which a Member of distinction could be elevated, but for which he could not apply. A Member who has attained the age of forty-five (45), who has been in good standing as a Member for a period of at least ten (10) years, and who has attained unusual distinction in the arts relating to the sciences of heating, ventilating, cooling or air conditioning, or the allied arts and sciences, or in the teaching of a major course in the arts and sciences, or who by reason of invention, research, original work, or as an engineering executive on projects of unusual or important scope, has made substantial contributions to the arts and sciences would be eligible to become a Fellow.

Proposals for both the Honorary Member and Fellow grades would require the signatures of ten (10) Members in good standing and two-thirds of the Council. An affirmative vote of fifteen (15) members of the Council would be required in order to confer the Honorary Membership or the grade of Fellow upon a Member.

In order to encourage Student applications the proposed changes provide that if a student is pursuing an approved engineering curriculum, and if his application is approved by an authorized faculty member it would be unnecessary that his name be published in the JOURNAL as a candidate or that his application be reviewed by the Admission and Advancement Committee.

The grade of Member would remain approximately as at present except that there would be no age requirement.

The Membership Committee, the Charter and By-Laws Committee, the Council, and your Officers have spent nearly two years in discussing and preparing these changes. We believe that they will be advantageous to the Society and recommend their adoption.

When these proposed amendments are sent to you, I suggest that you study them carefully and be prepared to vote on them next January.

J. E. Harris

President

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Electric Analogue Prediction of the Thermal Behavior of an Inhabitable Enclosure

By Harry Buchberg*, Los Angeles, Calif.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC. in cooperation with the Department of Engineering of the University of California.

SUMMARY — The thermal behavior of a one room test house of wood frame construction, subject to daily variations in microclimate, was predicted by solving the thermal circuit representing the idealized system through application of the thermal-electrical analogy with a resistance-capacitance network.

Input devices were developed to represent diurnal variations in air temperature, solar energy absorbed, and net long-wave radiation exchange. A long-wave radiation exchange resistance network including all interreflections for the interior surfaces is included in the analogue solution.

To determine the validity of the electric analogue predictions, measurements of the thermal environment and response of the test house were made during a period of clear weather in September, 1953. The predictions compare favorably with the observed data. Graphical comparisons of results are included.

The electric analogue solution of the thermal circuit of the test house demonstrated a high degree of flexibility and economy of effort in the rapid quantitative determination of the influence of many variables on the behavior of a complex thermal system.

THIS PAPER presents a thermal circuit analysis of the thermal response of a simple dwelling to the time variable micro-climate and shows how solutions of the circuit are obtained by electrical analogy. Consideration was given only to the temperature-time response of the structure and space and to the rate of heat loss or gain by the space without including moisture transfer. A direct determination of the sensible air conditioning load required to maintain the space at a constant temperature was also made.

Methods of calculating the instantaneous heat load based on solutions of the heat conduction equation are available in the literature. Under many conditions calculations based on these methods result in substantial errors of prediction. This is especially true when the influence of radiation exchange within the enclosure, direct solar transmission through transparent areas, ventilation, and thermal capacity of internal partitions and objects are of importance. Many experimental studies of the thermal behavior of full-scale systems have been undertaken and can be found in the literature. Such studies are costly in time and money and it behooves us to seek and develop methods of analysis which consider the entire system at once including the interactions at the boundaries.

One of the most powerful techniques for predicting the thermal behavior of complex heat transfer systems is the representation of the system and boundary conditions by a thermal circuit. Many investigations using this method of analysis have been reported in the literature[1]. Examples of the application of thermal circuit techniques to the specific study of the thermal behavior of buildings are few. Important contributions may occur in References 2, 3, 4, 5 and 6.

Space limitation made necessary the omission of considerable detail concerned with the representation of boundary conditions, the calculation of circuit parameters, the radiation exchange network within the house, and methods of lumping circuit parameters. Information on these subjects will be given in Appendixes‡ A, B, and C, which are scheduled to be published with the paper in the Society TRANSACTIONS, and in a second paper, Electric Analogue Studies of Single Wall Sections, soon to be available.

System Investigated

General Description: A one-room wood frame dwelling, shown in Fig. 1, constituted the thermal system studied. It is referred to as the *test house*. The test house is located on the roof of the Engineering Building B at the University of California, Los Angeles. This places the house approximately 50 ft above the ground level (longitude 118 deg 26 min, latitude 34 deg 4 min N) with a substantially unobstructed view to the east, west and south. The north side is obstructed by a 7-ft parapet running parallel to the north facing wall 10 ft distant. The long walls face exactly north and south, the south facing windows being protected from direct solar radiation during the months from June to October by eaves overhang. The south wall windows constitute the only glass area. The roof is very nearly a horizontal plane and is so considered in the analysis. As shown on Fig. 2, a schematic drawing of the thermal system being considered, the interior dimensions are 10.4 x 15.4 x 8.2 ft.

Construction Details: The test house is of Douglas Fir wood frame construction with walls of 1 in. exterior fir sheathing, 2 x 4 in. vertical studs placed 16 in. on center, and ¼ in.

†The investigation was carried out by the author in partial satisfaction of the requirements for the degree of Master of Science in Engineering.

*Department of Engineering, University of California.

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[1]Exponent numerals refer to References.

‡Mimeographed copies may be obtained upon request from ASHAE Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

interior plywood. The west wall only contains rockwool insulation batts (nominal 3 in. thick) in the air space between the studs. The ceiling is of open joist construction and the floor consists of 1 in. fir flooring nailed to 2 x 4 in. joists which rest on leveling wedges and on the roof of the Engineering Building. The roof covering is green roll asphalt roofing, one section of which is painted flat white as indicated in Fig. 2. The south wall windows are made of standard single glass sheets set into integral wall framing. Exterior surfaces are all painted a buff color.

Boundary Conditions during Test Period: The thermal behavior of the test house depends on the geometry and on the thermal properties of the structure and also upon independent functions or boundary conditions that describe the interaction of the system with its surroundings.

During the test period (week of September 7, 1953) the days and nights were clear and air temperature and movement were normal for that time of year except that the peak air temperature occurred later than usual. Radiation exchange occurred between the test house and the sun, the air mass, the engineering building roof, and the parapet at the north wall. Air movement was somewhat restricted under the floor of the house. A significant heat source existed inside the test house due to the recording equipment located there.

Instrumentation: The test house was provided with instrumentation for measuring the physical variables of the system that have an important influence on the thermal behavior. Measurements were made of the following variables:

1. Inside and outside surface temperatures.
2. Inside and outside wet and dry bulb air temperatures.
3. Heat fluxes across several inside surfaces.
4. Inside and outside air velocity.
5. Solar and total irradiation of a horizontal surface.

Conventional instrumentation such as thermocouples, aspirated psychrometers, heat meters, a hot coil anemometer, an Eppley pyrheliometer, and a total hemispherical radiometer[7] was used for all observations. Measurements were recorded continuously during the test period by high-speed, electronic, self-balancing potentiometers and a d-c amplifier and recording oscillograph, and provided the basis for the experimental results presented later in this paper.

Fig. 1—Test house located on roof of Engineering Building, University of California, Los Angeles

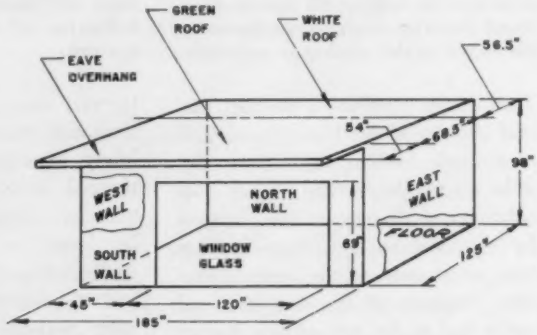


Fig. 2—Schematic diagram and dimensions of test house

Thermal Circuit Principles

Circuit representation of physical systems is a well established technique and requires little elaboration at this point. However, a few statements concerning the circuit representation of thermal systems and this particular application are in order.

Limitations and Advantages: At the outset it is important to recognize that the thermal system represented by a circuit is not the real physical system but rather an approximately equivalent system composed of discrete sections or lumps. Associated with each lump is a thermal capacity, all capacitors being appropriately interconnected by thermal resistance linkages, representing resistance to thermal energy transfer. Thus, the real distributed property system is replaced by a system of pure lumped thermal capacity interconnected with pure lumped thermal resistance. The two systems may be thought of as approaching equivalence as the size of the lumps become smaller and as the number of lumps approach infinity.

The error introduced by lumping the properties of the system is a function of the fineness of the lumping, the pattern of the lumping, the boundary conditions, the length of time after a change in input occurs, and the location in the network where the value of temperature or heat flux is required. An exact quantitative evaluation of the error can be made only by comparing the exact analytical solution of the distributed system with the solution of the difference equations representing the lumped properties system.[8] This procedure becomes very involved even with relatively simple boundary conditions and prohibitive with the boundary conditions involved in this investigation. The question of lumping was, therefore, evaluated experimentally by comparing the response of several different analogous electrical networks representing a single wall section. It is planned to present a report on these studies in the later pa-

per, Electric Analogue Studies of Single Wall Sections.

Thermal Circuit Representing the Test House

In order to work out a suitable thermal circuit for the test house, it was necessary to idealize the real physical system in the following:

1. All thermal energy transfer through structural elements is unidirectional and perpendicular to the long dimension of the element.
2. The test house is considered to be made up of 8 structural elements consisting of the west wall, east wall, north wall, south wall, south glass area, floor, white roof and green roof; all of which present parallel paths of thermal energy transfer into the enclosed space.
3. Each of the distributed property sections is replaced by lumped property sections.
4. The lumped thermal properties are constant and equal to the mean values of the real properties over the temperature range encountered.
5. The instantaneous temperature representing the average temperature of any plane surface is approximately equal to the actual temperature of the surface measured at its geometric center.
6. The air mass filling the enclosed space is considered to be at a uniform temperature at any instant, *i.e.*, thermal energy transferred to or from the air acts instantaneously on the whole mass to raise or lower its temperature uniformly spacewise.
7. Net radiation exchange with the inside air mass is negligible.
8. All surfaces radiate diffusely.
9. Negligible infiltration and leakage exists.
10. Any existing moisture transfer is negligible.
11. Incident solar radiation transmitted by any section is negligible.
12. Contact resistances through the conduction path are negligible.

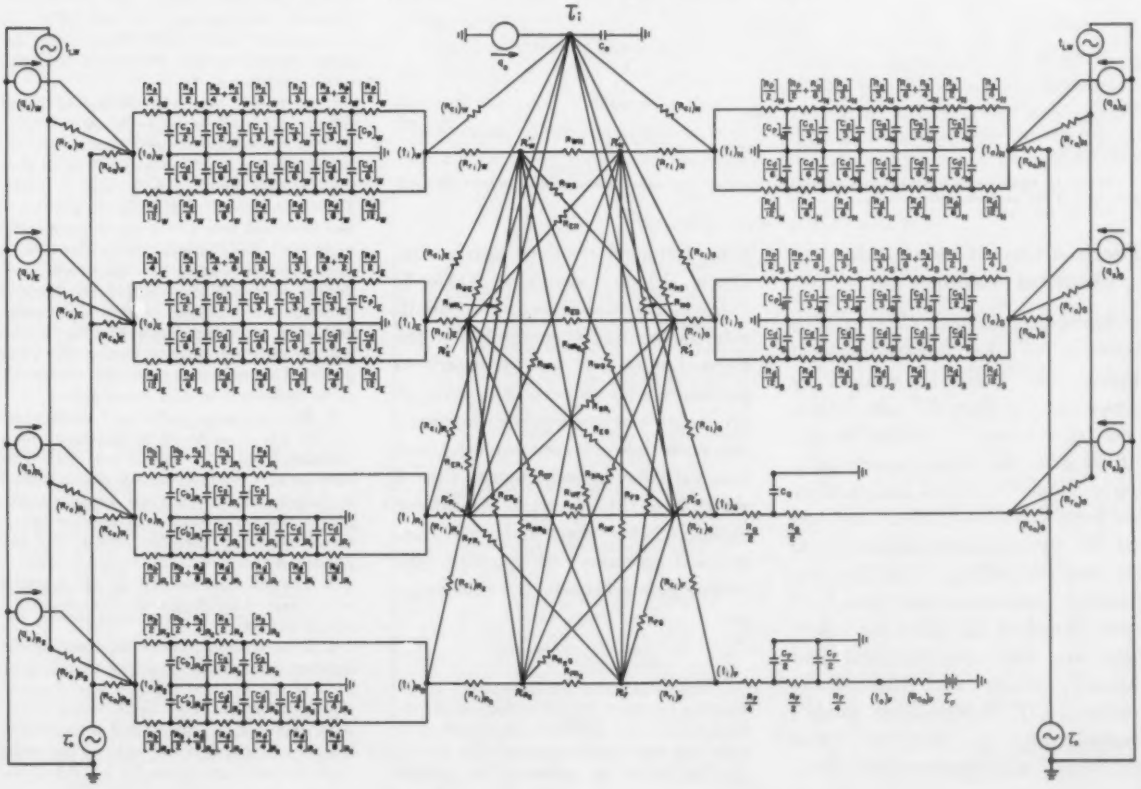
As a result, the diagram, Fig. 3, shows the thermal circuit of what may be called the *idealized* test house, and is the circuit which was solved to obtain the predictions mentioned later. (The symbols used in Fig. 3 are defined in Nomenclature and Symbols:). For purposes of description the circuit may be thought of as consisting of 3 parts:

1. Thermal conduction paths through the structural elements represented as parallel lumped R-C networks.

2. Radiation exchange between all interior surfaces represented by a resistance network.
3. Boundary conditions represented by time variable and constant temperature sources connected through appropriate thermal resistance to the network, and thermal energy generators at various points in the network.

On the inside of the test house thermal energy exchange takes place by convection to the air mass and by radiation exchange between all of the surfaces. The convection exchange is simply treated as a resistance to air mass, represented by a thermal capacitor. The radiation exchange is represented by a linearized resistance network that accounts for all interreflections as well as the first or fundamental exchange. It is recognized that interreflections are not of great importance in this instance, all emissivities being near unity; however, with little additional com-

Fig. 3—Thermal circuit representing the idealized test house



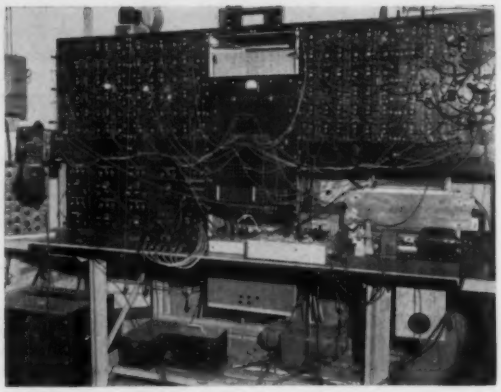


Fig. 4—Electric analogue of test house thermal system including (*a*) Input Devices, (*b*) R-C Network, and (*c*) Measuring Instruments

plexity all interreflections can be handled (see Appendix C). This serves as an example for cases where interreflections may be of importance.

The presence of recording equipment resulted in a significant thermal energy source within the enclosed space. From the instrument manufacturers ratings, it was estimated to be approximately 375 watts and is represented in the thermal circuit as a constant energy source or input device connected to the air capacitor.

To determine the sensible air conditioning load required to maintain the space at a constant temperature, a constant potential source was connected to the inside air temperature point and then grounded through an appropriate resistance. The potential drop across the resistance is proportional to the load.

acterizing the thermal circuit; (c) boundary conditions imposed are exactly the same for the electrical and thermal circuits and are correctly related in time.

To assure exact similarity between the electrical circuit used and the thermal circuit representing the test house the circuit diagram shown in Fig. 3 was considered to be the analogous electrical circuit. Appropriate scale factors derived to satisfy condition (b) are shown in Table 1.

Table 1—Summary of Ratios and Units of Analogous Electrical and Thermal Qualities[a]

Quantity	Units		Scale Factors	
	Thermal	Electrical	Ratio	Value
Time	hrs	sec	$\frac{\theta_e}{\theta_t}$	2
Capacity	$\frac{\text{Btu}}{^\circ\text{F}}$	Farads	$\frac{C_t}{C_e}$	8×10^6
Resistance	$\frac{^\circ\text{F}}{(\text{Btu/hr})}$	Ohms	$\frac{R_e}{R_t}$	16×10^6
Potential	$^\circ$F	Volts	$\frac{E}{t - t^{\circ b}}$	1
Rate of Energy Transfer	$\frac{\text{Btu}}{\text{hr}}$	$\frac{\text{Coulombs}}{\text{sec}}$ or Amperes	$\frac{q}{i}$	16×10^6

[a]Refer to Appendix B for the actual values of resistances and capacitances in thermal and electrical units used in the network representation.
[b]t° = Ref. Temp.

Thermal Circuit Solution by Electrical Analogy

Analogous Electric Circuit: The existence of the thermal-electrical analogy can easily be verified by comparing the finite difference equations representing the lumped thermal circuit with the equations representing a similar electrical circuit. This has been done many times and will not be repeated here. Suffice it to say that the analogy exists for any complex resistance-capacitance network providing the following conditions are met: (a) electrical and thermal circuits are schematically similar; (b) dimensionless moduli characterizing the electrical circuit are numerically equal to those char-

Boundary Conditions: To duplicate the boundary conditions of the thermal circuit it was necessary to provide electrical devices capable of producing the appropriate time-variable potentials, constant potential, and time-variable current inputs. Fig. 4 shows how this electrical equipment appeared when erected. In addition, it was necessary to establish the proper timing between the various inputs.

1. The time-variable potential corresponding to the *diurnal variation in air temperature* was obtained by means of a drum-type function generator. The particular function to be generated was plotted on rectangular coordinate paper. A copper or brass wire was laid over the curve and cemented to the paper which was then formed around a drum and secured. The drum was rotated by a drive mechanism causing the wire curve to act as a wiper against a fixed linear potentiometer. A constant voltage was impressed across the potentiometer resulting in an output voltage signal at the wire wiper proportional to the air temperature. Zero control and amplification of this signal was accomplished by means of a direct-coupled feedback amplifier known as an operational amplifier. Amplitude control was obtained by varying the ratio of input to feedback resistance, and zero control was obtained by adding a constant voltage to the function generator output through the operational amplifier. The signal was impressed on the network as a repeating function corresponding to the 24-hr air temperature cycle, and timed with the solar current inputs through a common drive mechanism.

A switching device consisting of timed relays was used to vary the outside convective resistance. It was found that the wind velocity averaged about 5 mph during the day and about 1 mph at night. Therefore, a different value of resistance was switched into the network during the night and day periods. A greater refinement in representing the non-linear convective resistance can readily be obtained by using a stepping switch and many values of resistance corresponding to the pattern of wind velocity during the 24-hr period. This refinement was not considered to be important in this investigation.

2. *The long-wave radiation boundary potential* was considered to be equal to a constant fraction of the air potential. This time-variable voltage signal was obtained by impressing the function generator output on the network through another operational amplifier used to adjust the amplitude as required.

3. The constant *under floor air potential* was obtained by means of a regulated d-c power supply.

4. Time-variable current representing the incident *solar radiation input* absorbed by each of the exposed surfaces was obtained through a special solar input circuit. Equations representing direct and diffuse solar irradiation absorbed by each of the walls were derived (see Appendix A). All of the

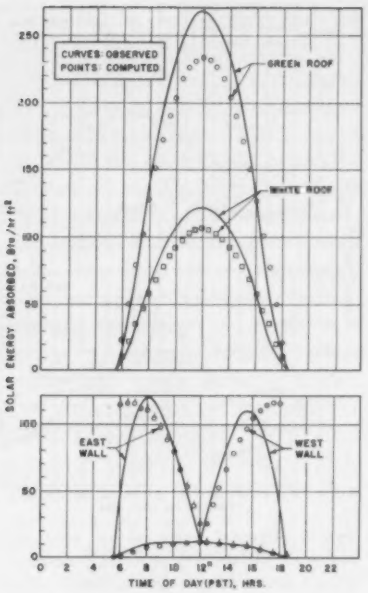


Fig. 5—Solar energy absorbed during the 24 hr period beginning September 8, 1953 (computed points are analogue predictions; curves are direct measurements)

equations are sine or cosine functions of time. The solar input circuit is simply a device to synthesize these equations and to deliver a time-variable current that is proportional by the proper scale factor to the incident solar radiation absorbed by each surface. The sine and cosine functions were generated by means of Scotch Yoke mechanisms which imparted a sinusoidal motion to the wipers of linear potentiometers. Operational amplifiers were used as adders and for amplitude control. Relays energized through a microswitch actuated by a cam on the Scoth Yoke crank were used to simulate sunrise and sunset. The output was limited to positive values of current by shorting the signal to ground through a diode vacuum tube at appropriate points in the circuit. Currents proportional to the amplifier output voltages were obtained through the use of current generators that produced a current output proportional to the voltage input.

Methods of Measurement: Measurement of voltages representing the inside and outside surface temperatures of all sections of the house and the inside air temperature at approximately 20 min intervals during a 24 hr cycle constituted the solution of the thermal circuit. The potentials were recorded on 35 mm film by means of a high speed electronic switch, cathode-ray oscillograph and oscillo-record camera.[9] A high impedance voltmeter was used for spot checks during a run.

In the determination of the sensible air conditioning load a d-c amplifier and recording oscillograph were used to measure the voltage drop across the resistor connected between the battery representing the constant inside air potential and ground.

Analogue Results: When the data from these measurements were converted to their thermal equivalents, they were plotted in the accompanying figures as points and labelled *Points-computed*. They are also referred to later as *analogue predictions* when they are compared with the *experimental results*, obtained by the data from instruments provided in the test house.

Experimental Results

Results of the observations of the thermal behavior of the test house during the 24-hr period beginning at midnight, September 8, 1953, are presented in Figs. 5 through 10. On these figures these results are curves without data points so that computed values representing the electric analogue predictions might be superposed wherever applicable for purposes of comparison.

Irradiation Data: The solar energy absorbed by the white and green sections of the roof is shown in Fig. 5. The curves, illustrating the experimental results, are based on the observed irradiation and the same values of absorptivity used in the analogue computations. The solar energy absorbed by the east and west walls is shown in Fig. 5. The observed data illustrated by the curves were calculated from the expression

$$q_s/A_n = (a_{nw})_n\,[(H_D)_n + \tfrac{1}{2}\,(H_d)_o] \quad \ldots\ldots\ldots\ldots (1)$$

where

$$(H_D)_n = (H_D)_o[Cos\ (Z_n - Z_n)/\tan h_n] \quad \ldots\ldots\ldots\ldots (2)$$

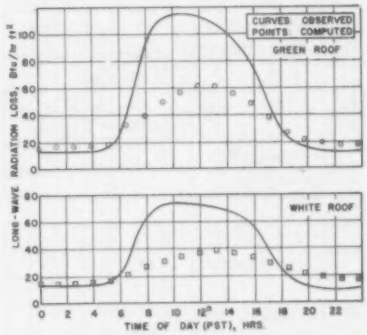


Fig. 6—Long-wave radiation loss from white and green roof sections during the 24 hr period beginning September 8, 1953 (computed points are analogue predictions; curves are direct measurements)

Nomenclature and Symbols

A = heat transfer area, square feet.
C = total heat capacity, Btu per Fahrenheit degree.
c_p = unit heat capacity (specific heat) at constant pressure, Btu per (pound) (Fahrenheit degree).
E = constant electrical potential, volts.
e = time variable electrical potential, volts.
H = irradiancy, or incident radiant flux per unit area, Btu per (hour) (square foot).
h = altitude angle, degrees.
I = constant electric current, amperes.
i = time variable electric current, amperes.
Q = thermal energy, Btu.
q = heat flux, Btu per hour.
R = radiosity, Btu per (hour) (square foot).
R' = linearized radiosity
t = surface temperature, Fahrenheit.
T = surface temperature, Fahrenheit absolute.
X = angle of incidence of the sun with respect to a surface, degrees.
Z = azimuth angle, degrees.

Greek Letters

a = absorptivity, dimensionless
ϵ = emissivity, dimensionless
θ = time
σ = Stefan-Boltzmann constant, 0.173×10^{-8}, Btu per (hour) (square foot) (degree Fahrenheit absolute)^4
τ = air temperature, Fahrenheit.

Subscripts

a = air space.
b = roofing material.
bb = black body.
c = convection.
D = direct solar radiation.
d = diffuse or scattered solar radiation.
E = east wall.
e = electrical circuit element.
F = floor.
g = ground.
G = glass.
h = overhang.
i = inside.
I = insulated wall space.
M = mean value.
N = surface normal to sun's rays.
N = north wall.
n = normal drawn to a surface.
n = any surface.
o = outside.
o = horizontal surface.
p = pyrheliometer measurements.
p = interior plywood.
p = parapet.
r = radiation.
R_1 = white roof section.
R_2 = green roof section.
S = south wall.
sky = atmospheric mass.
s = sun or solar.
s = sheathing.
t = thermal circuit element.
W = west wall.

Abbreviations

lw = long-wave radiation (also LW).
sw = short-wave radiation.

$(H_D)_o$ and $(H_d)_o$ being based on the pyrheliometer measurements. Equation 2 is simply arrived at from $(H_D)_n = (H_D)_N \cos X$ and the definition of cos X in the horizon system of coordinates. The value for α_{sw} was the same as that used in the analogue computations and the azimuth and altitude angles of the sun were obtained from Reference 10.

The net thermal energy absorbed by the white and green roof sections due to low temperature, long-wave

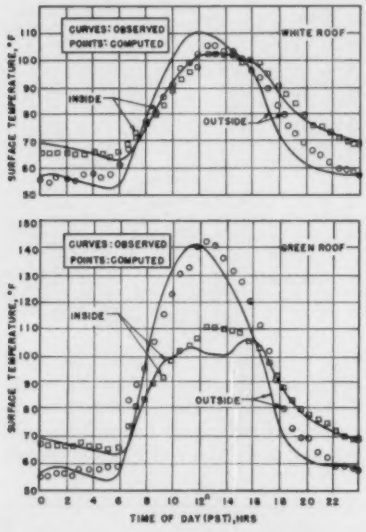


Fig. 7—Diurnal variation of roof surface temperatures (computed points are analogue predictions; curves are direct measurements)

radiation exchange is plotted on Fig. 6. The observed data (the curves) were obtained from the expression

$$(q_r)\ \text{net}/A_n = (\alpha_{lw})_n H_{sky} - (\epsilon_{lw})_n \sigma T_n^4 \quad \ldots\ldots(3)$$

where H_{sky} and T_n are measured quantities. Values for the radiation properties were the same as those used in the analogue computations.

Temperature Data: Several items regarding the temperature data given by the curves in Figs. 5 through 10 are noted as follows:

1. A drop in observed ceiling temperature under the green roof section beginning just before 12 noon may be noted on Fig. 7. According to steady state calculations an increase in conduction path resistance through the roof of approximately 3.5 times could cause a drop in ceiling temperature of about 10 F with the assumption that $(t_o)_{R_2}$ and τ_i are substantially independent of the roof conduction resistance. At this time of day $(t_o)_{R_2}$ is influenced mainly by the net radiation exchange and outside convection resistance. An increase in conduction path resistance by a factor of 3.5 can be realized by the presence of an air space approximately ½ in. thick. The presence of such an air pocket over the measuring point was substantiated by other data which indicate that the degree of dip in the ceiling temperature during this period is very sensitive to the outside surface temperature. On very bright warm days with high peak roof temperatures the dip was accentuated while on cool cloudy days the dip disappeared. This was undoubtedly caused by expansion and contraction of the air pocket (verified by inspection), a well known defect in rolled roof coverings.

2. Referring to Fig. 8, it can be seen that the outside surface temperature of the east wall rose very rapidly shortly after 8:00 a.m. On the other hand, the solar radiation absorbed by an unobstructed east wall based on measurements of horizontal irradiation increased steadily after 5:40 a.m. reaching a peak at 8:00 a.m. as shown in Fig. 5. The reason for this seemingly inconsistent behavior can be explained by the fact that the east wall of the test house, at the level of measurement, was actually shaded from the sun until approximately 8:00 a.m. by a building wall approximately 50 ft to the east.

3. Observed south wall surface temperatures are not shown on Fig. 9 because these temperatures were not recorded during the test period.

Wind velocity data as a function of time are not presented in this paper, although measurements were made. Reduction of the oscillogram tapes require more time and effort than was thought to be warranted at this time. The average wind velocity on September 8, 1953 was between 4 and 5 mph during the day and about 1 mph at night.

Analogue Predictions Compared with Experimental Results

Predictions of the thermal behavior of the test house are shown as points superposed on graphs of observed temperature-time history for a 24-hr cycle during the test period. Figs. 7, 8, and 9 present the surface temperatures, and Fig. 10 the diurnal variation in outside and inside air temperature. The boundary inputs for various surfaces are given in

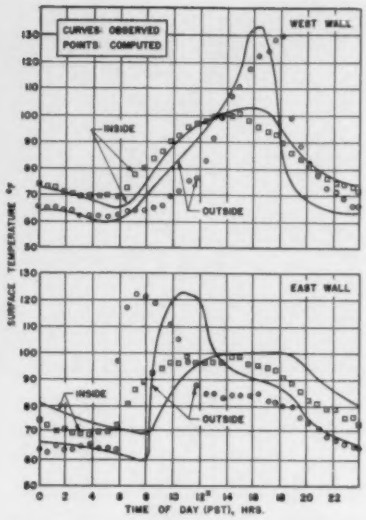
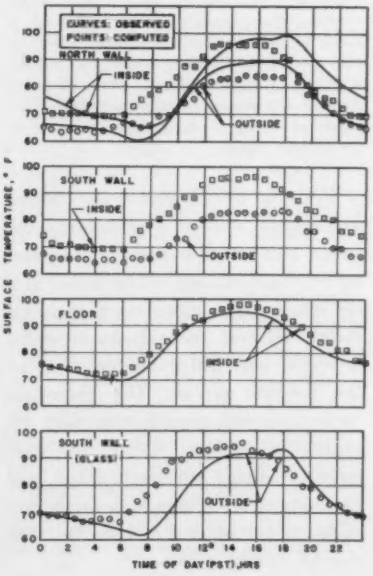


Fig. 8—Diurnal variation of west and east wall surface temperatures (computed points are analogue predictions; curves are direct measurements)

Figs. 5 and 6 to aid in the interpretation of the analogue results.

Prediction of the sensible air conditioning load, Fig. 11, required to maintain the space at a constant temperature of 76 F was obtained as a second solution of the thermal circuit. The diurnal variations in heat flux at the inside surface of the vari-

Fig. 9—Diurnal variation of north wall, south wall, floor, and glass surface temperatures (computed points are analogue predictions; curves are direct measurements)



ous walls, the roof sections, and the floor are also given in Fig. 11.

Boundary Inputs: The difference between the computed and observed inputs, shown in Figs. 5 and 6, is due mainly to the approximation that the irradiation of a surface normal to the sun's rays is constant during the day and equal to the integrated mean value. The sharp rise in solar energy absorbed by the east wall after sunrise and the sharp drop at the west wall at sunset are due to relay limiters in the solar radiation input circuit.

A compromise (see Appendix A) in the choice of long-wave radiation potential resulted in considerably lower computer values of net loss during the day compared to the observed data shown in Fig. 6. This was compensated for partially by the low mid-day computer values of solar input.

Prediction of Surface Temperatures: The predicted roof and ceiling temperatures, shown in Fig. 7, are in good agreement with the measured values.

As indicated by Fig. 8, the predicted inside surface temperatures of the west wall agree well with observed temperatures. The predicted east wall temperature cycle agrees well in amplitude but is considerably out of phase, leading the observed temperature cycle by approximately 3 hr. The difference in phase for the outside surface temperature can be explained by the shading of the east wall of the test

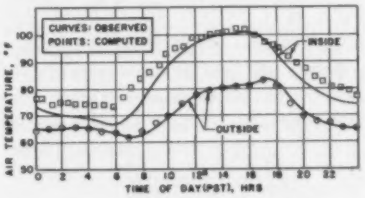
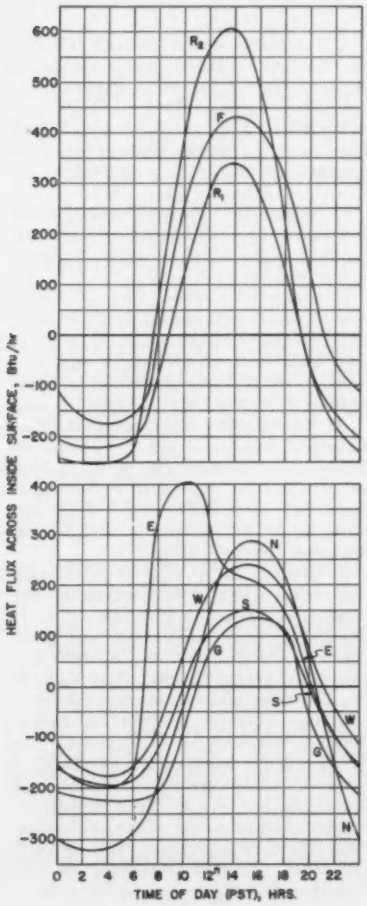


Fig. 10—Diurnal variation of outside and Inside Air Temperature (Computed points are analogue predictions; curves are direct measurements)



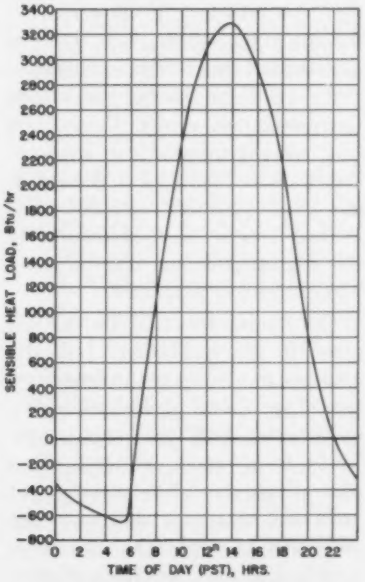


Fig. 11—Diurnal variation of sensible air conditioning load to maintain constant air temperature (76F) and the single surface heat fluxes (analogue prediction)

house for approximately 2½ hr after sunrise and by the sharp rise in the computed radiation input immediately after sunrise. The inside surface temperature follows the inside air temperature rather closely and also indicates some response to the rising outside surface temperature during the morning.

The predicted north wall outside surface temperature cycle, shown in Fig. 9, compares favorably with the observed values except that they are as much as 5 F less during the afternoon. This difference may be accounted for by the fact that reflection from the north parapet was neglected. The predicted inside surface temperature cycle leads the observed cycle but is similar in amplitude. It may be noted that the predicted surface temperature cycle is approximately in phase with the inside air temperature cycle. No comparison can be made with the predicted south wall temperatures since observed data were not recorded. It can be seen, however, that in this case again the inside surface temperatures follow closely the inside air temperature pattern.

The predicted inside floor surface temperature cycle, shown in Fig. 9, agrees well with the observed data both in phase and amplitude. The predicted south wall glass temperatures run considerably higher than the measured values during the morning hours approaching the inside air temperature between 9:00 and 10:00 a.m. On the other hand, the measured values approach the outside air temperature. The peculiar increase in glass temperature observed beginning about 5:00 p.m. was probably caused by direct rays of the sun coming in under the overhang from the west shortly before sunset.

Discussion and Conclusions

Examination of the test house thermal circuit and results of the first analogue solution (uncontrolled inside air temperature) reveals the potency of the recording equipment heat source in establishing the space temperature. This heat source was estimated at 1280 Btu/hr which would be sufficient to cause an air temperature rise rate of over 50 F per hour

if no heat losses occurred. The major heat loss from the space during the day was through the floor, north wall, and south wall glass area. At night the greatest losses were due to heat transfer through the roof and the glass area. As one would expect, the insulated west wall was responsible for the least total heat loss from the space and the green roof section was responsible for the greatest heat gain with the exception of the heat source in the house. The heat source due to diffuse radiation was not accounted for in the circuit at this time. It may be included by connecting the output of current generators to each of the inside surface potentials. It was estimated that the floor and north wall would absorb diffuse solar radiation at an approximate rate of 250 Btu/hr and the remaining surfaces together approximately 120 Btu/hr during the day. Additional solutions are planned for the future to determine the importance of this source.

There appears to be a definite discrepancy in the predicted glass temperature (Fig. 9). Indications are that the outside glass surface resistances were much too large. Increased heat loss through the glass during the day (a more reasonable result) would have reduced the daytime inside air temperature prediction.

In general, it may be stated that the predictions of the thermal behavior of the test house are good. All of the previous discussion simply points to the fact that the thermal circuit solution can only be as good as the representation of the actual physical system and the ability to evaluate quantitatively the circuit parameters and boundary conditions. The value of the thermal circuit technique of analysis lies in the ability to see the total picture at once and to estimate the importance of the separate influences. The electric analogue solution has demonstrated a high degree of flexibility and economy of effort in the rapid quantitative determination of the influence of many variables on the behavior of a complex thermal system.

For the first solution, actual heat fluxes across the various surface boundaries were not computed from the analogue data because the method of calculation could result in large errors. The heat flux across any inside surface boundary is determined by taking the difference (a small number) of two relatively large quantities (surface and air potentials) measured above ground and dividing by the convective resistance. It can be shown that errors of as little as 1 percent in each of the temperatures involved in the computation of heat flux can result in errors of 100 percent or more for different surfaces and times involved in these studies. For the second solution, involving a constant inside air potential, the inside surface potentials were measured with respect to this constant value resulting in a much more accurate determination of heat fluxes. In addition, the measuring unit was modified to allow the expansion of the voltage range required over the full scale of the oscillograph.

It is estimated that lumping errors, instrumentation errors, leakage errors, all put together can result in errors of the order of 5 percent in any one quantity computed. The greatest area of interpretation lies in the original postulates and the evaluation of circuit parameters.

The studies described are the first phase in the application of electric analogue techniques to the determination of space heating and cooling requirements. Additional studies currently being conducted and others planned for the future involve: (1) reduction of circuit elements (simplification of lumping); (2) determination of the importance of separate influences such as radiation inputs at the various inside surfaces, ventilation or heat sinks, inputs at the exterior surfaces due to solar and longwave radiation; (3) determination of the effectiveness of shading devices, high solar reflectivity paints, capacitance and/or insulation in different locations, and evaporative cooling of roofs in reducing the actual cooling load; (4) study of methods for including the influence of landscaping in the thermal circuit; (5) study of the effect of the physical variables on an occupant by introducing into the thermal circuit the network representing the human thermal system; and (6) the introduction of equipment characteristics and control programming to the network.

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A Rapid General Purpose Centrifuge Sedimentation Method for Measurement of Size Distribution of Small Particles

Part II — Procedures and Applications

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This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC. in cooperation with the Department of Mechanical Engineering of the University of Minnesota.

SUMMARY — Data are included illustrating the reproducibility, comparative accuracy and principal applications of the method. Tables show chief sedimentation liquids and dispersing agents found useful and the dispersion systems used when various materials are analyzed. Graphs show results of analyses on many finely divided materials including flours, pigments, albumin, industrial dusts, fly ash, and an atmospheric dust sample. The method has proved useful and rapid. It is hoped that its use will permit analysis of atmospheric dusts containing particles as small as 0.2 μ (micron).

PART I of this paper† described the basic principles and apparatus of a new, rapid, general purpose centrifuge-sedimentation method designed for the economical determination of particle-size distribution in the 0.05 to 100 micron size range.

Since sedimentation analysis of particle size distribution is an indirect measurement, a number of factors must be considered when interpreting the results. A recent symposium of the *British Institute of Physics* has discussed many of these factors comprehensively.[1] In addition to those factors common to all sedimentation methods, a number are peculiar to this centrifuge method. The data and discussion that follow illustrate some of the most important conclusions reached as a result of numerous comparisons with other methods and evaluations by the various investigators using this method. Because reproducibility is affected by the techniques used, certain important procedures are described in detail.

Selection of the Dispersion System

As many investigators have pointed out, adequate dispersion is perhaps the most important factor affecting the validity of sedimentation results. For this reason, the choice of liquids, of dispersing agents and the method of dispersion depend more on the overall quality of the dispersion than on the physical properties of the system. Workable dispersion systems as well as practical methods for selecting the best system are discussed.

Sedimentation and Feeding Liquids

The particles to be analyzed must be practically insoluble in both the feeding and sedimentation liquids. Solubility may be determined from handbooks if the material is known, or by shaking a small amount of the dust and the liquid being tested in a test tube. Occasionally a mixture of materials will be encountered in which at least one of the components will be soluble in all the liquids tried. For such cases judgment must be exercised in interpreting the resulting size analysis.

Usually the feeding liquid is made up by mixing a miscible liquid of lower density with the sedimentation liquid in such a proportion that the density difference between the feeding and sedimentation liquid is about 10 percent of the density difference between the particles and the sedimentation liquid. It has also been found that the adverse effects of density streaming can be decreased further if the feeding liquid has a 20 to 50 percent greater viscosity than the sedimentation liquid. This is especially helpful when analyzing powders of high density, having coarse, relatively narrow size distributions.

Some of the most useful sedimentation liquids are given in Table 1. Mixtures of benzene, carbon tetrachloride, naphtha and U.S.P. mineral oil can be made up to have just about any density and viscosity desired. The viscosity characteristics of these mineral oil mixtures are determined almost completely by the low viscosity component. Thus the viscosity characteristics of succeeding batches mixed in the same proportion will be close enough to make repeated viscosity determinations unnecessary.

Some appropriate feeding and sedimentation liquids for specific materials are tabulated in Table 2.

Dispersing and Wetting Agents

Table 2 shows that for most materials it is necessary to add either a dispersing agent, or a wetting agent and sometimes both, to get a satisfactory dispersion. In addition to the data in Table 2, recommendations for many other materials may be found in a book by Herdan[2] (p. 451). If a dispersion system must be found

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†A Rapid General Purpose Centrifuge Sedimentation Method for the Measurement of Size Distribution of Small Particles, Part I — Apparatus and Method, by K. T. Whitby (ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1955, p. 231).

[1]Exponent numerals refer to references.

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for a material not listed in the literature then the dispersion criteria given further on in this paper or those given by Herdan[2] can be used.

Dispersion Criteria

A test tube can be used to obtain a fair indication as to whether a given dispersion system is satisfactory. If a small amount of powder, shaken in a test tube with the system being tested, forms a turbid suspension with no visible flocculation and then settles as a sharply defined spot in the middle of the rounded bottom of the test tube, this is an indication that wetting and dispersion are satisfactory. On the other hand, if the particles settling on the bottom form an irregular sediment layer, it is a sign that sufficient interaction of the particle has taken place to cause trouble during the size analysis.

Direct observation of the sedimenting particles in the centrifuge tube is also a fairly good criterion. No flocculation or sticking of particles to the tapered portion of the walls of the tube should be visible. Sometimes such sticking is caused by improper cleaning of the tubes after changing from a hydrophobic to a hydrophilic sedimentation liquid or vice versa. Thorough brushing with acetone before changing liquids will usually eliminate this source of trouble.

The final height of the sediment column should show no change as the centrifuge speed is increased after sedimentation is complete except for soft materials such as flour. Even for flour no appreciable change is noticeable until the speed is increased over 2000 rpm. That this should be a good criterion is reasonable. Since essentially one size particle is settling at one time in the capillary, the void space should be constant and a minimum if the particles do not interact as they come to rest. Any interaction will tend to cause the void space to be greater than the minimum and will permit reorientation of the particles as the centrifugal field is increased. Compression of the sediment column with increasing centrifuge speed is therefore an indication that the dis-

Table 1—Useful Sedimentation Liquids and Dispersing Agents

Sedimentation Liquid	ρ_0 — gm/cc 80 F	η_0 — C.P. 80 F	Dispersing and Wetting Agents[b]
Water	0.997	0.863	Household Detergents, A, B, C, D, E, Tetra Sodium Phosphate and many others.
Acetone			E
Benzene	0.872	0.582	D
Carbon Tetrachloride	1.583	0.883	D
35% M.O.[a] — 65% Kerosene	0.827	4.004	D
1/3 M.O. — 2/3 Carbon Tet.	1.332	2.132	D
1/3 M.O. — 2/3 Benzene	0.866	1.122	D
Isopropal Alcohol			Sodium Oleate

[a]U.S.P. Heavy Mineral Oil.
[b]A — Non ionic wetting agent; B — Polymerized salts of aryl alkyl sulfonic acids; C — Lignin sulfonic acid compounds; D — Sodium sulfonate of mineral oil; E — Dioctyl sodium sulfosuccinate.

Table 2—Dispersion Systems for Various Materials Analyzed by the Centrifuge Method

Item	Material		Sedimentation Liquid	Feeding Liquid[a]	Dispersing Agent	Concentration Dispersing Agent[a]	Method of Dispersion[b]	Quality of Dispersion
1	Glass beads		C.T.[c]; Bz	Mixture of M.O. Bz.			Shaking or	Excellent
2	Quartz	2.65	or Mixtures	C.T. or Naphtha of	D	0.05	Microstirrer	
3	Silicon Carbide	3.13	with M.O.	correct density and viscosity				
4	Aluminum Oxide	3.89						
5	Limestone							
6	Manganese Dioxide	5.45	Bz	60 Naphtha; 40 Bz	D	0.1	Blender	Good
7	Chrome Yellow	6.16	Bz	Kerosene	D	0.1	Blender	Excellent
8	Titanium Oxide	3.8	Water	70 H_2O; 30 Acetone	C	0.2	Blender	Excellent
9	Clay	2.7	Water	70 H_2O; 30 Acetone	C, A	0.2:0.05	Blender	Excellent
10	Phosphate Fertilizer	3.28	Water	70 H_2O; 30 Acetone	B	0.1	Blender	Excellent
11	Calcium Carbonate	2.70	Water	70 H_2O; 30 Acetone	C	0.1	Blender	Excellent
12	Zinc Stearate	1.16	Acetone	50 Acetone; 50 Naphtha	— — —	— — —	Blender	Good
13	Arizona Road Dust	2.69	Bz; C.T.	Mixture of Bz, C.T. and Naphtha	D	0.05	Blender	Excellent
14	Arizona Road Dust	2.69	Water	70 H_2O; 30 Acetone	C, A	0.2:0.05	Blender	Excellent
15	Air Filter test dust — mixture of Arizona Road dust, carbon and lint.	2.5	Water	70 H_2O; 30 Acetone	C, A	0.2:0.05	Blender	Excellent
16	Fly ash	2.61	Water	70 H_2O; 30 Acetone	C, A	0.2:0.05	Shaking	Excellent
17	Biological Material[d]	1.37	Bz	50 Bz: 50 Naphtha	D	0.1	Blender	Excellent
18	Flour[e]	1.44	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking in chamber	Excellent
19	Powdered Milk	1.30	Bz	50 Bz: 50 Naphtha	— — —	— — —	Malted milk mixer	Excellent
20	Corn dextrin	1.50	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking in chamber	Excellent
21	Starch	1.50	Bz	50 Bz: 50 Naphtha	D	0.5	Malted milk mixer	Excellent
22	Alfalfa meal dust	1.45	Bz	50 Bz: 50 Naphtha	— — —	— — —	High Blender	Excellent
23	Citric acid	1.54	Bz	50 Bz: 50 Naphtha	D	0.5	Speed Blender	Excellent
24	Cellulose-paper fibers	1.52	Bz	50 Bz: 50 Naphtha	D	0.1	Shaking	Excellent
25	Flax Sheaves	1.48	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking	Excellent
26	Ground beet pulp	1.41	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking	Excellent
27	Cocoa	1.45	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking	Excellent
28	Soy bean meal	1.40	Bz	50 Bz: 50 Naphtha	— — —	— — —	Shaking	Excellent
29	Egg albumin	1.30	Bz	50 Bz: 50 Naphtha	D	0.5	Shaking	Excellent
30	Aspirin Powder	1.41	Kerosene	Naphtha	— — —	— — —	Blender	Good
31	Powdered sugar	1.59	Isopropal Alcohol	50 Iso; 50 Naphtha	sodium oleate sugar	Sat.	Malted Milk Mixer	Excellent

[a]Figures in this column are percentages.
[b]In all cases the blender is the high-speed type.
[c]Abbreviations: C.T. (carbon tetrachloride), Bz (benzene); M.O. (mineral oil).
[d]Biological material is dry viable.
[e]The flour is wheat, rye or rice.

persion system is not completely satisfactory.

Replicate particle size analysis with different amounts of mechanical agitation and different amount of dispersing agents, should give the same size distribution if the dispersion is complete. This is a very severe criterion and may be difficult to use if the particles are themselves moderately strong aggregates of smaller particles.

Table 3—Reproducibility data from 43 Runs on a Single Small Sample of Glass Beads[a]

% by Wt. Less Than	d Microns	σ Microns	σ %
95	35.2	0.9	2.6
50	24.2	0.4	1.6
5	16.3	0.8	4.9

[a]Sed. Liquid — 1/3 Heavy Mineral Oil, 2/3 Carbon Tetrachloride, Graduated tubes.

Dispersion Methods

The dispersion method used will depend on the material being analyzed. In some cases considerable experimentation may be required to establish the severity and length of mixing required to get the desired degree of dispersion. For all but a few situations one of the four methods discussed later has been satisfactory.

Table 4—Particle Size Analyses of Calcium Carbonate

Microns	% by Weight Less Than Size				Avg
	Run 1	Run 2	Run 3	Run 4	
9	96.5	97.8	97.0	97.9	97.3
6	83.9	85.7	84.0	86.3	85.0
4	65.5	65.9	62.0	66.3	64.9
2	33.3	30.7	30.0	31.6	31.4
1	11.5	10.9	11.0	11.6	11.2
0.7	6.9	5.5	5.0	5.3	5.7
0.4	2.3	2.2	2.0	2.2	2.2
0.2	0	0	0	0	0

Percent by Weight Less than	d Microns	σ Microns	σ %
95	8.0	0.3	3.7
50	3.1	0.1	3.2
5	0.64	0.01	1.6

Sed. Liquid — Water; Graduated Tubes; Dispersed in high speed Blender.

Easily dispersed materials such as flour, glass beads abrasives and other relatively coarser or hard materials can usually be dispersed by shaking in the dispersing chamber with the appropriate feeding liquid.

For more difficult-to-disperse materials, the micro-stirrer illustrated in Fig. 6, Part I may be used. Dispersion directly in the feeding chamber is especially convenient for routine analysis because it is then unnecessary to prepare and transfer a separate suspension.

Materials which have more than a few percent by weight of particles below 1 micron usually require more severe mixing. For these either a malted milk mixer or a high-speed blender may be used.

For such very fine materials as paint pigments and for some coarser materials that tend to form strong agglomerates, severe working in a viscous medium may be required. One satisfactory technique is to mix a paste of powder in a heavy mineral oil on a glass plate with a spatula. After several minutes of mixing a small amount of the paste is diluted with a miscible liquid of low viscosity and placed in the feeding chamber.

If there is any question as to the effect of the dispersion method on a given material, comparative size analyses using different dispersion techniques can be run. Data of this kind often shed light on the nature of the agglomeration and size distribution of the primary particles.

Concentration of Particles in Feeding Liquid: The concentration of particles must give the desired sediment height in the tubes. Considerable experimentation has shown that 10 to 15 mm is satisfactory for graduated tubes and 4 to 5 mm in ungraduated tubes. The 0.75 mm tubes are used for all powders except those having a density less than about 1.8. The best layer of feeding liquid can be formed if the feeding chamber is from one-half to three-fourths full. Since the reproducibility does depend somewhat on the thickness of the feeding layer, care should be taken to use exactly the same volume of feeding liquid if highest reproducibility is required.

Reproducibility of the Method: Experience has shown that for the majority of applications, the reproducibility of a size analysis method is considerably more important than the accuracy defined by comparison with some other method. This is true because most methods have certain inherent biases which are usually dependent on particle shape and other variables.

Tables 3, 4, and 5, show typical reproducibility data for three different situations. Table 3 is a summary of 43 replicate runs on a single small sample of relatively narrow size range glass beads made as part of an evaluation of the method. The particle sizes at the 95, 50, and 5 percent less than points on the distribution, were read from the plotted and smoothed cumulative size distribution curves. These data are indicative of what may be expected on easily dispersed mineral materials having fairly narrow size distribution.

The four replicate runs on calcium carbonate shown in Table 4 are typical of what may be expected on fine powders. The average of these four runs is shown in Fig. 1, Curve B.

Table 5, and Curve F of Fig. 1, show replicate runs on a sample of cake flour made by different operators using different reading schedules. This level of reproducibility was attained only after passing the flour through a high-speed mixer.

Table 5—Particle Size Analyses of a High Speed Mixer Blended Cake Flour

Operator A, March 6, 1953				Operater B, August 4, 1953				
Size Microns	Percent Less Than Size			Size Microns	Percent Less Than Size			Avg
	Run 1	Run 2	Avg		Run 1	Run 2	Run 3	
87.5	100.0	100.0	100.0	80	99.2	100.0	99.3	99.5
75.0	98.3	98.3	98.3	70	97.7	97.8	97.8	97.8
62.5	94.3	93.4	93.9	60	92.4	92.1	92.4	92.4
50.0	82.0	82.0	82.4	50	84.8	82.8	85.5	84.4
37.5	69.8	67.9	68.9	40	74.9	72.8	76.0	74.4
25.0	49.4	48.4	48.9	35	68.1	65.6	69.5	67.7
12.5	19.3	18.0	18.6	30	60.2	59.2	62.9	60.8
				25	49.8	49.1	51.4	50.8
				20	34.6	33.4	37.5	35.2
				12	15.6	15.4	15.0	15.3
				8	8.6	8.9	8.4	8.6
				5	4.2	3.2	3.4	3.6
				2.5	1.1	1.0	1.1	1.1
				1	0	0	0	0

Sed. Liquid — Benzene
Graduated tubes

Journal Section

Comparisons with Other Methods: For those applications where it is desired to further evaluate the meaning of the Stokes equivalent spherical diameter, it is necessary to make comparisons with other methods. Differences between sedimentation and other particle size methods such as the microscope arise from two different sources. First, the sedimentation size depends on particle drag which depends on particle shape and particle roughness. This is a fundamental characteristic common to all sedimentation methods. Second, most sedimentation methods have certain other biases determined by the particular apparatus and sensing method used. While it is desirable to minimize the latter biases, compromise is usually necessary to achieve the desired economy of operation. Though these biases are difficult to evaluate separately since they depend on the material being analyzed and other variables that depend on the particular situation, a qualitative discussion is helpful in judging the possible effect of each. Following are a number of these factors.

1. *Conversion of Volume Measurement to Weight Measurement*: Actually this method measures the volume-size distribution. However, if the particle shape is constant with size then the void fraction will be the same for the different sizes because only one size particle is coming to rest in the capillary at any given time. Under these conditions the assumption of a linear relationship between the sediment height and the weight-distribution is satisfactory.

2. *Decreasing Sedimentation Height with Increasing Sediment Height*: The magnitude of this effect depends on the ratio of the total sediment height to the assumed settling distance. For the graduated tubes the maximum sediment height is about 15 mm and the assumed settling distance is 100 mm. Under these conditions the theoretical maximum error is about 4 percent. Though the net effect of this error would be to narrow the actual size distribution, in practice factors 3 and 4 following, tend to cancel it.

3. *Density Streaming*: A suspension of particles in a liquid tends to act like a liquid having a density greater than that of the pure liquid. If such a suspension is then floated on the surface of the pure liquid, irregular streamers of the suspension will be observed settling through the liquid. Such streamers are minimized in this method by suspending the particles in a feeding liquid of lower density and higher viscosity than the sedimentation liquid and by using low concentrations of particles. It has been discovered, however, that this streaming, though minimized, tends to spread very narrow size distributions slightly making them appear broader than they actually are.

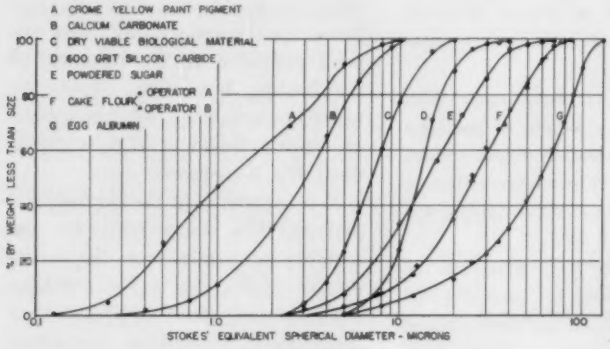

A CROME YELLOW PAINT PIGMENT
B CALCIUM CARBONATE
C DRY VIABLE BIOLOGICAL MATERIAL
D 600 GRIT SILICON CARBIDE
E POWDERED SUGAR
F CAKE FLOUR * OPERATOR A * OPERATOR B
G EGG ALBUMIN
% BY WEIGHT LESS THAN SIZE
STOKES' EQUIVALENT SPHERICAL DIAMETER - MICRONS

Fig. 1—Typical particle size analyses on different materials

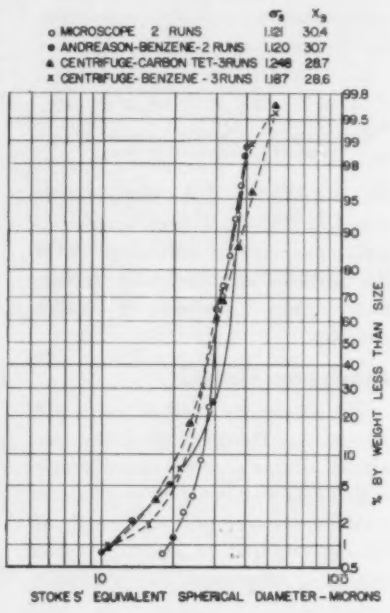
Fig. 2—Comparative size analyses on a roller type elutriator classified sample of glass beads ($\rho = 2.34$)

This effect is illustrated in Fig. 2, where size distribution measurements by microscope, by standard Andreason pipette and by centrifuge sedimentation, on a narrow size fraction of glass beads, are compared. Though the medians of the distributions measured by the different methods are nearly the same, the geometric standard deviation by the centrifuge method is greater than by microscope. This effect is serious only for distributions having a geometric standard deviation less than about 1.2 except for materials having a density above 4. For these high density materials some spreading may occur at geometric standard deviations up to 1.5, if the median is above 20 μ(microns).

Fig. 3 (Part I) illustrates the relatively good agreement with the Andreason pipette for broad distributions.

4. *Hindered Settling in the Tapered Portion of the Tube and in the Capillary*: Since the tapered portion of the tube and the capillary comprise about 50 percent of the total settling height, it might be imagined that hindered settling might cause considerable difficulty.

Actually it has been observed that if there is no sticking of particles on the walls of the tapered portion and no choking at the entrance of the capillary caused by all the particles of a narrow distribution arriving at once, then these effects are small. Sticking can be eliminated by proper dispersion systems and proper cleaning, while choking is eliminated by using the projection system to permit accurate reading of small sediment heights.


σ_g X_g
o MICROSCOPE 2 RUNS 1.121 30.4
• ANDREASON-BENZENE-2 RUNS 1.120 30.7
▲ CENTRIFUGE-CARBON TET-3RUNS 1.248 28.7
× CENTRIFUGE-BENZENE - 3RUNS 1.187 28.6
% BY WEIGHT LESS THAN SIZE
STOKES' EQUIVALENT SPHERICAL DIAMETER - MICRONS

Experience has shown that the comparative accuracy and reproducibility is satisfactory for the measurement of all but very narrow size distributions. Even for this special case, the method is useful if it is evaluated against the microscope for the particular material and conditions of interest. The following study of size analysis results on wheat flour serves to illustrate how such an evaluation may be carried out.

The object of this evaluation was to obtain data by means of which the Stokes equivalent spherical diameter within the range of flour particle sizes could be converted to microscope, sieve, or count and weight size. Because of its low viscosity benzene is usually used as the sedimentation liquid for routine size analysis of wheat flour. Unfortunately the

largest flour particles are above the size where Stokes' law begins to be in error. Thus the lack of agreement between the centrifuge and other methods is a combination of deviation from Stokes' law, particle shape and the other effects peculiar to the centrifuge method.

Deviation from Stokes' law begins when the terminal velocity of a particle exceeds a certain Reynolds number and the flow around the particle begins to change from streamline to turbulent. Oseen has derived an equation from which the error in Stokes' law can be calculated as a function of particle size. Oseen's equation is given by Rose[3] as:

$$d_o = d_s\ (1 + 0.095\ R_s) \quad \ldots\ldots\ldots (1)$$

where

d_o = the true diameter of a spherical particle.

d_s = the diameter of a spherical particle calculated from Stokes' law for a given terminal velocity.

R_o = the Reynolds number of the sedimenting particle.

If R_o and d_s are replaced by their equivalents in terms of the constants of the particular system under consideration, then Equation 1 becomes:

$$d_o/d_s = 1 + (0.095\ \rho_o\ d_s\ h/\eta_o t) \quad \ldots (2)$$

From Equation 2, the ratio d_o/d_s can be calculated for any given values of h, t, and d_s. This ratio is tabulated in column 9, of Table 6, as a function of particle size. Note that it ranges from about 1 at 50 μ to 1.264 at a true particle size of 177 μ. This ratio between true particle and calculated particle size applies only to spherical particles. For irregular particles an additional factor which includes the effects of shape and the biases of the sedimentation method must be determined by comparison of the sedimentation analyses with analyses by the other methods. Because it is difficult to obtain accurate microscope size distributions on the relatively broad original distributions a series of narrow sieve fractions of the flour were prepared by techniques described elsewhere[4]. The particle size distributions of these narrow fractions were then measured by centrifuge sedimentation, by microscope and by a count and weight technique that yields the average particle volume of the size fraction[4]. If the particle shape is assumed to be spherical, a count and weight equivalent spherical diameter can be calculated. This diameter designated by d is given in column 2, Table 7. With reasonable care d can be reproduced within $\pm$ 0.5 percent for fractions having a mass median above 30 μ. Therefore d is a good reference to which the size measured by other methods can be compared.

Table 7 gives the mass median particle size as measured by count and weight, centrifuge, microscope and the mean nominal mesh opening of the two sieves used to make each fraction. In Fig. 3, the microscope and sedimentation size are plotted on the ordinate versus the count and weight diameter d on the abscissa. Also d_o is plotted on the abscissa versus d_s on the ordinate to indicate the deviation of the sedimentation results as calculated from Oseen's law.

Note that the equivalent spherical diameter by sedimentation, d_{sp}, is less than the count and weight spherical diameter d and less than the diameter calculated from Oseen's law by approximately a constant factor. This factor tabulated in column 7 of Table 7, includes the effects of particle shape and the biases of the centrifuge method relative to the count and weight method. This fac-

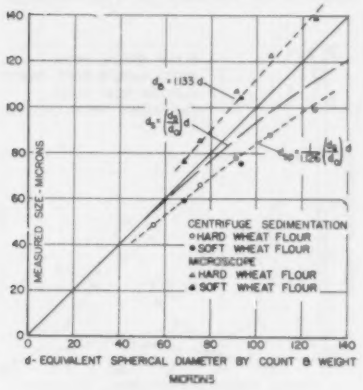


Fig. 3—Comparison of the mass median of flour fractions measured by different methods with the calculated deviations from Stokes' law

Table 6—Relationship of Sedimentation Size to Size Measured by Microscope, Count and Weight and Sieving for Wheat Flour[a]

(1) d_{sp}	(2) d_o	(3) d	(4) d_b	(5) d_a	(6) $\frac{d}{d_{sp}}$	(7) $\frac{d_b}{d_{sp}}$	(8) $\frac{d_a}{d_{sp}}$	(9) $\frac{d_o}{d_s}$
140	177.0	199.2	225.3	217.2	1.423	1.610	1.552	1.264
120	138.7	156.0	176.0	169.9	1.300	1.469	1.417	1.156
100	108.5	122.0	177.8	133.0	1.220	1.378	1.330	1.085
80	83.5	94.1	106.2	102.5	1.176	1.328	1.281	1.043
70	72.0	81.0	91.5	88.2	1.157	1.307	1.260	1.028
60	61.2	68.5	78.0	75.2	1.148	1.298	1.252	1.020
50	50.5	56.8	64.2	62.0	1.137	1.285	1.240	1.010
40	40.0	45.0	50.8	49.0	1.126	1.271	1.227	1.000
30	30.0	33.8	38.1	36.8	1.126	1.271	1.227	1.000
20	20.0	22.5	25.4	24.5	1.126	1.271	1.227	1.000

[a]All dimensions in microns.

Table 7—Particle Size Data on Wheat Flour Sieve Fractions

(1) Fraction	(2) d	(3) d_b[a]	(4) d_a[b]	(5) d_{sp}	(6) d_o	(7) $\frac{d_s}{d_{sp}}$	(8) $\frac{d_a}{d}$	(9) $\frac{d_b}{d}$
Hard Wheat								
100/120	125.5	138.7	137.0	98.3	113.2	1.152	1.074	1.087
120/140	106.0	122.5	115.0	88.0	98.0	1.112	1.086	1.156
140/170	91.0	107.0	96.5	78.0	86.3	1.107	1.061	1.176
170/230	75.3	85.4	75.0	66.2	72.7	1.100	0.977	1.134
230/325	55.0			48.7	54.5	1.120		
Soft Wheat								
120/170	93.1	104.4	106.5	75.7	88.0	1.162	1.143	1.122
170/230	68.2	76.6	75.0	59.5	66.5	1.117	1.100	1.123
			Mean value			1.126	1.074	1.133

[a]Dimension measured is breadth of particle in column 2.
[b]d_a = mean of nominal sieve mesh opening of two sieves used to make the fraction.

tor, represented by the ratio d_s/d_{sp}, and the one resulting from the deviations from Stokes' law may be summed up in an equation of the form:

$$d = d_o = (d_s/d_{sp})\ (d_o/d_s)\ d_{sp}. \quad (3)$$

where

d_{sp} = Stokes' equivalent spherical diameter for the irregular particles calculated from the observed terminal velocity.

d = the equivalent spherical diameter by count and weight.

d_o = Oseen's spherical diameter — true diameter of a spherical particle.

d_s = Stokes' equivalent spherical diameter calculated from the observed terminal velocity of a spherical particle.

For the data of column 7, Table 7 there is no significant variation in the ratio d_s/d_{sp} with particle size so that d_s/d_{sp} may be taken equal to the mean of the seven values. Therefore, for flour in benzene:

$$d = 1.126\ (d_o/d_s)\ d_{sp}$$

where

d_o/d_s = a function of particle size calculable from Equation 2.

In a similar manner, the ratios d_a/d and d_b/d, were calculated and tabulated in Table 7. From the mean values of these ratios in combination with the ratio d_o/d_s calculated from Equation 2 the data of Table 6 were obtained. Using these data it is possible to convert d_{sp} to the corresponding count and weight, microscope or nominal sieve size.

Applications of the Method

Table 2 illustrates the great diversity of materials and conditions under which the method has been used. Not included in the table are a great many industrial dusts of unknown or uncertain chemical composition which have been analyzed. For such dusts the exact meaning of the particle size calculated from Stokes' law depends on how accurately the density is known. If sufficient powder is available for a conventional density determination, a particle size based on the average density can be calculated. The error in the particle size will be approximately equal to:

$$\text{percent error in } d = 100\left[1 - \sqrt{\frac{\rho_{assumed} - \rho_o}{\rho_{true} - \rho_o}}\right]$$

The seriousness of this error depends on the application of the size analysis. Few applications have arisen in which this error has been a serious factor.

Fig. 1 illustrates a number of size analysis on different materials having different size distributions. For low density materials, such as flour, egg albumen and powdered milk the method is useful up to a maximum particle size of about 175 μ if the deviations from Stokes' law are taken into account. Curve C is interesting because the entire distribution was determined by centrifuge without any gravity settling. It also shows that up to 12 centrifuge times may be used if necessary.

The distributions of Fig. 4 are typical of a great variety of industrial dusts that have been analyzed. Curve B shows the abrupt break at about 14 μ, which is typical of the average industrial cyclone.

Curve D is an analysis of a fly ash sample collected by electrostatic separator at the Paddy's Run Plant of the Louisville Gas and Electric Co.

The atmospheric dust sample curve C is typical of a number of such samples taken from electrostatic air cleaners in Pittsburgh. The application of the centrifuge method to the size analysis of atmospheric dusts will be discussed in a future paper.

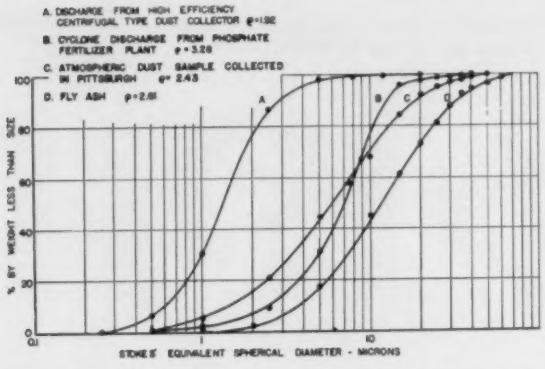

A. DISCHARGE FROM HIGH EFFICIENCY CENTRIFUGAL TYPE DUST COLLECTOR ρ=1.92
B. CYCLONE DISCHARGE FROM PHOSPHATE FERTILIZER PLANT ρ=3.28
C. ATMOSPHERIC DUST SAMPLE COLLECTED IN PITTSBURGH ρ= 2.43
D. FLY ASH ρ=2.61
% BY WEIGHT LESS THAN SIZE
STOKES EQUIVALENT SPHERICAL DIAMETER - MICRONS

Fig. 4—Particle size analyses on several typical dusts

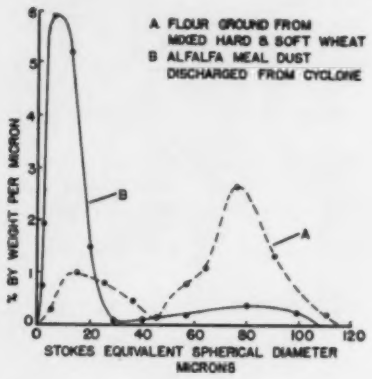

A FLOUR GROUND FROM MIXED HARD & SOFT WHEAT
B ALFALFA MEAL DUST DISCHARGED FROM CYCLONE
% BY WEIGHT PER MICRON
STOKES EQUIVALENT SPHERICAL DIAMETER MICRONS

Fig. 5—Two materials showing a bimodal distribution. For the flour the peak at 17 microns is caused by free starch granules from the soft wheat and the one at 75 microns by halves of whole cells from the hard wheat

Work is being done to extend the method to milligram quantities of atmospheric dusts collected by filter, by electrostatic sampler or other methods. At present the smallest sample which can be analyzed is about 1 mg, but it is hoped that this can eventually be reduced to about 0.2 mg by using finer capillaries in the tubes.

Two materials having bimodal size distribution are shown in Fig. 5. This method is especially valuable for studying such distributions because of the ease with which extra points on the distribution curve can be determined.

Figs. 6 and 7 show size analysis on dust fractions classified by two different methods from A.C. Fine Composite test dust. From this type of log-probability plot the goodness of the classification is easily seen.

It will be noted that even though some of these were reclassified many times, there is still considerable material below the designated lower limit of the fraction. This characteristic usually is caused by the inability of the classifier to separate the fine particles adhering to the large.

The centrifuge method has also been useful in the development of fine grinding and classifying equipment. A few points on the distribution curve of the ground product could be determined rapidly enough so that adjustments and changes could be made without shutting the machine down. This speed in analyzing results permitted considerable economy of material and time. Likewise in several other applications the economical determination of large numbers of size distributions has permitted statistical studies that would have otherwise been impractical.

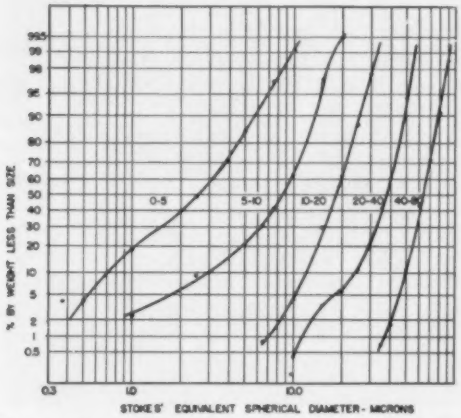


Fig. 6—Size distribution of roller type elutriator classified fractions of A.C. Fine Air Cleaner Test Dust

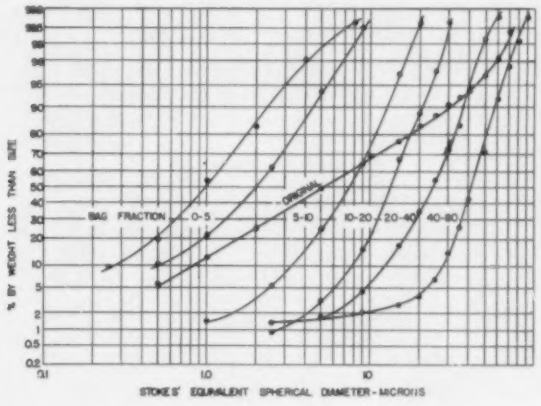


Fig. 7—Size distribution of fractions of A.C. Fine Air Cleaner Test Dust classified by repeated runs through a commercial cyclone type air classifier

Acknowledgments

The author is grateful for the help from the following individuals during the development of this method: Dr. R. C. Jordan, head, Mechanical Engineering Department, University of Minnesota, for making laboratory facilities available, and Prof. A. B. Algren, head, Heating, Air-Conditioning and Refrigeration Division, Mechanical Engineering Department, for activating the research project.

The author gratefully acknowledges the courtesy of the following organizations in providing certain samples and data presented in this paper: Minnesota Mining and Manufacturing Co. for providing the data given in Table 3 and 4, and to General Mills, Inc. for the data of Curve C, Fig. 1; Superior Grain Separator Co., American Air Filter Co., Farr Co., *Industrial Hygiene Foundation*, Pillsbury Mills and the Fram Corp. for providing certain samples of dust analyzed and used as illustrations.

References

1. The Physics of Particle Size Analysis (*British Journal of Physics*, Supplement No. 3, 1954).
2. *Small Particle Statistics*, by G. Herdan (Elsevier Publishing Co., New York, 1953).
3. *The Measurement of Particle Size in Very Fine Powders*, by H. W. Rose (Constable Co., Ltd., London, 1953).
4. The Mechanics of Fine Sieving, by K. T. Whitby (Ph.D. Thesis, University of Minnesota, Minneapolis, Minn., 1954).

BIBLIOGRAPHY ON H-P, H-T HOT WATER HEATING

For the assistance of the TAC on Hot Water and Steam Heating, the Laboratory has prepared a bibliography on High-Pressure, High-Temperature, Hot Water Heating. The bibliography covers forty-nine titles of papers published between 1935 and July 1954. Although put together primarily for the TAC, copies in the mimeographed pamphlet are available. Request should be directed to the ASHAE Laboratory, 7218 Euclid Avenue, Cleveland 3.

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Industrial Ventilation (A Manual of Recommended Practice) issued by the Committee on Industrial Ventilation, P.O. Box 453, Lansing, Mich. Gift of K. E. Robinson.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

PROGRAM — 1955 SEMI-ANNUAL MEETING

American Society of Heating and Air-Conditioning Engineers

June 27-29, 1955

St. Francis Hotel, San Francisco, Calif.

All Functions on Pacific Daylight Saving Time

Saturday — June 25

9:30 a.m. Finance, E. R. Queer, *Chairman—Room 210*
3:00 p.m. Chapter Relations, P. B. Gordon, *Chairman—Room 220*
7:00 p.m. Executive, John W. James, *Chairman—Room 210*

Sunday — June 26

9:30 a.m. COUNCIL MEETING — *Room 220*
10:00 a.m. REGISTRATION — *Green Room*
2:00 p.m. Research Executive, B. H. Jennings, *Chairman*
3:00 p.m. WELCOME TEA (Sacramento Chapter, Hosts)

Monday — June 27

9:00 a.m. REGISTRATION — *Green Room*
9:30 a.m. FIRST TECHNICAL SESSION — *Italian Room*
Call to Order by Pres. John E. Haines
Welcome by D. E. McLeod, Vice President, Golden Gate Chapter
H. B. Nottage, *Vice Chairman*
Electric Analogue Prediction of the Thermal Behavior of an Inhabitable Enclosure, by Harry Buchberg
A Method for Determining Winter Design Temperatures, by M. K. Thomas
Periodic Heat Flow Through Flat Roofs, by D. J. Vild, M. L. Erickson, G. V. Parmelee and A. N. Cerny
12:30 p.m. WELCOME LUNCHEON — *Colonial Room*
Chairman: G. M. Simonson
Toastmaster: C. E. Bentley
Speaker: Major General William F. Dean, U.S.A.
Subject: Military Requirements of Today
1:00 p.m. Golf tournament — *Olympic Country Club*
2:00 p.m. Long-Range Research Program Committee—*Room 212*
2:00 p.m. TAC on Air Cleaning, A. B. Algren, *Chairman—Room 220*
2:00 p.m. Sightseeing Trip — Scenic Boat Ride on San Francisco Bay
7:00 p.m. "Forty-niner" Get-Together Party — *Surf Club* at Beach

Tuesday — June 28

9:00 a.m. REGISTRATION — *Green Room*
9:30 a.m. SECOND TECHNICAL SESSION — *Colonial Room*
Call to Order by First Vice Pres. John W. James
B. H. Jennings, *Vice Chairman*
Ventilation of Commercial Laundries, by Sidney Marlow
Air Conditioning Coil Odors, by A. B. Hubbard, Nicholas Deininger and Frederick Sullivan
A Rapid General Purpose Centrifuge Sedimentation Method for Measurement of Size Distribution of Small Particles, Part II—Procedures and Applications, by K. T. Whitby
Size Distribution and Concentration of Air-borne Dust, by K. T. Whitby, A. B. Algren and R. C. Jordan
10:30 a.m. Sightseeing Trip: Golden Gate Bridge, Muir Woods
1:30 p.m. Nominating, B. L. Evans, *Chairman—Room 221*
2:00 p.m. Chapters Conference, J. S. Burke, *Chairman—Italian Room*
6:00 p.m. Informal Dining at Fisherman's Wharf, International Settlement, other famous restaurants
8:45 p.m. San Francisco Night Club Tour

Wednesday — June 29

9:00 a.m. REGISTRATION — *Green Room*
9:15 a.m. Ladies Continental Breakfast — *Mural Room*. Conducted Tour of Stores followed by Luncheon in Chinatown.
9:30 a.m. THIRD TECHNICAL SESSION — *Colonial Room*
Call to Order by Second Vice Pres. P. B. Gordon
T. E. Taylor, *Vice Chairman*
Sources of Vent Gas in a Hot Water Heating System, by L. N. Montgomery and W. S. Harris
Psychrometric Analysis for Design of Forced Draft Cooling Towers, by S. E. Agnon and B. H. Spurlock, Jr.
Resistance of Wooden Louvers to Fluid Flow, by C. W. Bevier
Performance and Evaluation of Room Air Distribution Systems, by Alfred Koestel and G. L. Tuve.
10:00 a.m. Ladies' and Children's Sightseeing and Luncheon: Golden Gate Park, Aquarium, Zoo and Ocean
2:00 p.m. EVAPORATIVE COOLING SYMPOSIUM — Wm. T. Smith, *Chairman*
Historical — R. M. Phillips, Jr.
Air Cooling by Evaporation — S. F. Duncan
Evaporation from Surfaces — R. J. Petersen
Weather Data Limitations — Stuart Giles
Geographical Limitations — Robert Ash
System Design — Richard Hukill
Indirect Systems — D. T. Robbins
Water Treatment — R. M. Westcott
Discussion Period
Report of Committee on Resolutions
Unfinished Business
New Business
Adjournment
6:30 p.m. Social Hour — *Italian Room*
7:00 p.m. SEMI-ANNUAL BANQUET — *Colonial Room*
Toastmaster: Dr. B. M. Woods, Past President of ASHAE and Vice President, University Extension, University of California
Invocation: Rev. John Collins
Presentation of Past President's Memory Book to L. N. Hunter by Pres. John E. Haines
Presentation of Golf Trophies
Past Presidents' Research Bowl by M. F. Blankin
Eichberg Memorial Cup
Paul Bunyan Cup
Speaker: Dr. A. M. Zarem, Manager, Southern California Division, Stanford Research Institute
Subject: Smog — A Challenge to Technology
Dancing

Aerial view of downtown San Francisco showing Golden Gate and San Francisco Bay bridges

The Golden Gate Awaits You!

Those attending the Semi-Annual Meeting 1955 at the St. Francis Hotel in San Francisco this June 27, 28 and 29 will have the opportunity to attend interesting technical sessions, a symposium on evaporative cooling, and participate in a number of pleasant social functions. Particularly impressive is the Monday Welcome Luncheon at which Major General William F. Dean, U. S. A., will be the guest speaker. General Dean gained world recognition for his heroic activities in Korea and his address will be a message everyone will want to hear.

Registration will begin on Sunday, June 26, and in the afternoon there will be a Welcome Tea sponsored by the members of the Sacramento Chapter. Meetings of Council and the Finance, Executive, Chapter Relations, Chapters Conference and Nominating Committees, and others, will take place prior to and during the Semi-Annual Meeting.

Pres. John E. Haines will call the Semi-Annual Meeting to order on Monday morning, June 27, at 9:30 in the Italian Room of the St. Francis Hotel. After an exchange of official greetings several By-Law amendments drafted by the Charter and By-Laws Committee and endorsed by Council will be presented. They are outlined below in the Meeting Notice.

NOTICE OF SEMI-ANNUAL MEETING 1955

Please take notice that the Semi-Annual Meeting 1955 of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS will take place in San Francisco, Calif., at the St. Francis Hotel, Powell and Geary Sts., at 9:30 a.m. on Monday, June 27, 1955. Members of the Society have been informed of the program published in the ASHAE JOURNAL SECTION of Heating, Piping & Air Conditioning.

Eleven papers are scheduled for presentation at the three technical sessions and a Symposium on Evaporative Cooling will be conducted.

By-Law amendments proposed by Council will be presented on the following subjects:

1. A plan for membership grades and qualifications consistent with the recommendations of the Engineers Council for Professional Development.

2. A regional-director plan for chapter operations.

3. Changing the Guide Committee year to commence in November.

4. Eliminating the necessity of publishing student applicants' names in the Journal.

The proposed amendments were endorsed by Council at its April 15th meeting and it was voted to give notice at the Semi-Annual Meeting in San Francisco that they would be presented for adoption at the 62nd Annual Meeting in January 1956.

J. E. HAINES
President

A. V. HUTCHINSON
Executive Secretary

May 20, 1955

Heat Flow Through Glass

By R. A. Miller*, Pittsburgh, Pa.

EXTENSIVE use of glass in modern buildings emphasizes the need for dependable data on the flow of heat through glass areas. Engineers should have complete information if they are to provide adequate cooling systems which can be economically installed and operated.

Society research on heat flow through glass has been an important activity since 1933. In 1936 the TAC on Air Conditioning Requirements of Glass was organized, and the present name of the committee was adopted in 1948. A summary of the Committee's work appeared in RESEARCH BULLETIN No. 1 (July 1947) and in subsequent papers in the Society's TRANSACTIONS. M. L. Carr, Pittsburgh, Pa., served as chairman from the inception of the committee until his death July 13, 1942, at which time he was succeeded by the writer who has served as chairman ever since.

In 1952, under a new plan of organization of TAC's, a vice-chairman became necessary, and N. B. Hutcheon has filled that position since that time. Many different members of the Committee on Research have served on this committee, and at present both Dr. Hutcheon and the writer are members of the Committee on Research.

The reflecting and absorbing characteristics of glass of various compositions and forms, and the effectiveness of shading devices, require considerable study, because in the summer solar energy transmitted by glass is frequently a major factor in the load imposed on the cooling system.

The heat loss through windows of an ordinary residence, exclusive of infiltration, may amount to 25 percent of the heat supplied. The percentage in the so-called solar house is even greater, especially at night, though this may be more than offset by the gains from the transmitted solar energy in sunny weather. For this reason the insulating effects of shades, drapes, double glazing and storm sash are very important.

During the early years of the committee, considerable research was done at the Pittsburgh Testing Laboratory and at the Society Research Laboratory in the U. S. Bureau of Mines Building, Pittsburgh, under the direction of the late Dr. F. C. Houghten. These researches developed some interesting and valuable information which has been fully published.

Shortly after the Society Research Laboratory was established in Cleveland under the directorship of the late Cyril Tasker, the research staff undertook to review and evaluate all of the available data on the subject. The lack of much-needed information led to the formulation of a comprehensive research program which has been in operation since early 1945. The initial response of industry, especially that of the glass industry, to help finance the program was most gratifying, and very substantial support has continued to the present time.

Special apparatus was constructed for the various investigations, including a calorimeter for the exact determination of heat gain or loss through various fenestrations and shading devices. The calorimeter exposes the fenestration to the sun and natural weather conditions on one side, and provides a controlled environment for the opposite side.

The program has contributed many research bulletins on the general problems of heat flow through fenestrations of all kinds. These included single glazing with plate, window and heat-absorbing glasses, double glazing with various combinations of these types, a number of patterns of rolled or configurated glass, and eight different types and sizes of glass block. An extensive analytical and experimental study was made of louver-type sunshades such as Venetian blinds.

Many of the results of this program appear in THE GUIDE 1955 as U-values in Chapter 9, *Heat Transmission Coefficients of Building Materials*, and as heat gain tables and shade factors in Chapter 13, *Cooling Load*. Besides these specific data, other information of more general use has come out of the program. This includes data on forced convection heat transfer, on long-wavelength radiation from the atmosphere and ground, and on short-wave solar radiation from the sun and sky. Additional data remain to be developed.

The TAC on Heat Flow Through Glass contemplates further study of louver-type awnings and plastic fenestrations of various types. Continued attention also will be given to new developments in building and the related needs of the air conditioning industry so that appropriate research programs may be initiated by the committee.

*Chairman, Technical Advisory Committee on Heat Flow Through Glass.

Regional Meeting at Oklahoma City Draws Record Attendance

The two-day meeting, featured by the technical sessions, brought forth some interesting discussions — some are given in full and some are abstracted.

WITH the Oklahoma Chapter as host, the Regional Meeting at Oklahoma City, April 14-16, 1955, was the first held under the new ASHAE name. It also marked the first such meeting since the war, and broke the attendance record with a total registration of 241. This was made up of 123 Members, 44 Guests, and 74 Ladies. As expected, the largest attendance was from Oklahoma but registrants were present from 17 states and the District of Columbia and Canada.

Two technical sessions, social events and meetings of Council and various committees were all arranged under the direction of W. J. Collins, Jr., general chairman, Committee on Arrangements and the following subcommittee chairmen: *Entertainment & Banquet* — F. X Loeffler, Jr., *Finance* — A. C. Shelley, *Ladies* — L. E. Wickline, *Publicity* —E. W. Gray, *Registration and Reception* — M. K. Cohenour, *Sessions* — J. R. Patten, *Transportation* — J. H. Carnahan. The result of their efforts was the well-rounded, interesting and enjoyable meeting.

MORNING SESSION, SATURDAY, APRIL 16, 10:00 a.m.

Pres. John E. Haines opened the session at 10:00 a.m. in the Crystal Room of the Skirvin Hotel, and at once called on W. J. Collins, Jr., general chairman, who extended the welcome of the Oklahoma Chapter, outlined the features of the program, and asked for all to register.

President Haines then introduced A. W. Edwards, general chairman, Committee on Arrangements, for the 62nd Annual Meeting at Cincinnati in January 1956, who told of the attractive program planned for that meeting and extended an invitation for all to attend.

Pres. John E. Haines presents his report to the membership at the technical session in Oklahoma City

The President Reports

President Haines offered no formal report but told of his recent visit to the Canadian Conference in Toronto, and mentioned that he had visited more than 40 of the present 59 chapters in the last few years. He reported also that the organization of two new chapters at Baton Rouge and Springfield, Mass. is approved.

For the first time the total membership of the Society, with present applications, exceeds 10,000. He was also much pleased with the activities and accomplishments of the various committees so far this year.

He took the opportunity of outlining some of the problems currently facing the Officers and Council and indicated that solutions are being actively sought.

He also expressed the hope that Regional Meetings would continue and that the Society and its research activities would continue to meet its responsibilities to the industry and the general public.

President Haines then turned the meeting over to Second Vice Pres. P. B. Gordon who read the rules and asked for the presentation of the first technical paper. This paper, Pressure Losses of Divided-Flow Fittings, by S. F. Gilman (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1955, pp. 141-147) was presented by W. A. Grant, Syracuse.

Abstracts of discussions follow.

JOHN EVERETTS, JR., Philadelphia, Pa., drew attention to Fig. 5 of the paper. He had noted that in that figure the loss coefficients — one for a straight outlet and one for a conical outlet — are in a two to one ratio. The other data, however, did not include a conical outlet but a straight outlet. He thought that a conical outlet might be far more important, in a dual duct system with its varying air quantities at high velocity, for example, in relating pressure losses than would be indicated in the paper.

CLOSURE (W. A. GRANT) Mr. Grant indicated that he could not really close adequately for the author, but would refer the points raised to Dr. Gilman.

Chairman Gordon then introduced R. R. Irwin, Stillwater, Okla., who presented his paper, Panel Cooling for a Residence (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1955, pp. 175-177).

H. E. DEGLER, Kansas City, Mo., (WRITTEN): This *guarded hot box* method to provide summer comfort in a residential unit with a panel cooling system and using a cooling tower as the only source of cooling effect is indeed a contribution to the literature.

Professor Irwin says that the inside temperature at no time exceeds 82½ F with outside temperatures as high as 106 F. For the conditions shown in Fig. 3, what was the temperature of the water to and from the cooling tower? How much water was in the cooling system, and what was the rate of circulation?

It would be interesting to know what improvement could be shown in the cooling ability of this system if a mechanical draft cooling tower were used instead of a natural draft type. It is my opinion that this substitution would provide 3 to 5 deg of additional cooling. I wish that Professor Irwin would comment on this substitution of type of cooling tower.

R. S. ASH, Phoenix, Ariz., (WRITTEN): This paper represents a valuable contribution to the use of the evaporative cool-

ing process for comfort conditioning. The various methods of indirect evaporative cooling deserve much needed research.

In the Southwest, evaporative cooling of attic spaces to reduce the summer heat gain on air conditioning systems using mechanical refrigeration, has been tried with considerable success. On some installations, it has been possible to cool the structure with three tons of refrigeration where five tons would have been required if evaporative cooling of the attic space had not been practiced.

Professor Irwin mentions in his paper that evaporative systems are being superseded in many areas. I presume he is referring to the State of Oklahoma. On the contrary, more evaporative air coolers were installed in Oklahoma in 1954 than in any previous year. Actually Oklahoma is one of the largest users of evaporative coolers, exceeding in use states such as New Mexico and Arizona.

Although the prevailing summer wet-bulb temperature in Oklahoma is fairly high, direct evaporative cooling is quite popular. The coolers are usually sized to change the air every minute or every minute and one-half. This results in an air movement of about 10 fpm in the occupied space and is responsible for reducing the effective temperature an additional 1 to 2 deg below that shown on a still air effective temperature chart.

In my opinion, the results that can be achieved with direct evaporative cooling, taking into account the economics involved, do not justify the panel cooling method. However, as a means of reducing the heat load on a mechanical refrigeration system, it has considerable promise.

J. R. Watt, Austin, Tex., (Written): Professor Irwin must be congratulated for performing this experiment. His results emphasize a principle long evident to many engineers in the Southwest: air conditioning is possible in this region without the expensive equipment necessary in more humid areas.

Unfortunately, manufacturers design cooling equipment for the East, Southeast, and Middle West, not the Southwest. Thus, local engineers and contractors must usually forfeit the cooling possibilities afforded by the climate. Their customers thereafter consume 40 to 60 percent more power than necessary, taxing already overburdened utility companies.

What seems needed is further development of equipment like Professor Irwin's which uses evaporative cooling principles to cool rooms without adding humidity to the air enclosed. His failure to reach the *comfort zone* is accidental; the traditional ASHAE Comfort Chart ignores radiant cooling. The Bio-Climatic Chart* does not and would show Professor Irwin's true success.

Two experimental dry air evaporative coolers of 3-ton size are now being readied for testing at the University of Texas. Other experiments in the general field of *indirect* or *dry-air* evaporative cooling are detailed in a 1954 report from the University of Texas to the U. S. Naval Civil Engineering Research and Evaluation Laboratory, Port Hueneme, Calif. I believe copies are available upon application.

Professor Irwin's process is especially promising because it combines with radiant heating. It is hoped commercial development will arise from his pioneering.

John Everetts, Jr., Philadelphia, Pa., found the paper of interest especially because it describes results from an installation where the temperatures of the surrounding surfaces are controlled rather than the psychrometric conditions. With psychrometric control and no control of surface temperatures, he believed that the limit of tolerance is only about 1½ or 2 deg from optimum. However, it would appear that, with panel cooling, this limit is extended to perhaps 4 or 5 deg. He felt that the reason the tenants of the tested dwelling found comfort at conditions outside the usual psychrometric comfort chart is that such charts do not take radiation into account. Work is to be undertaken at the ASHAE Laboratory soon which will re-evaluate comfort including the radiation effect.

G. V. Parmelee, Cleveland, Ohio, believed that the Society should be more active in an investigation of this kind. He felt that perhaps something similar could be used in commercial buildings to remove heat from lights. He wondered if any trouble such as sliming had been experienced with the water in the tower.

John W. James, Chicago, Ill., asked if the author could give information about operating method, type of pumping equipment and electric consumption. He felt there was much interest in this subject of liquid heat and cooling systems. He told of a Chicago contractor who had put panel cooling in housing developments and had used water from the city supply and had obtained some cooling effect. He believed data of the kind in the paper would be of interest to such people. He observed that this contractor had not experienced trouble from condensate collecting on the cooled ceiling. He also mentioned use of a baseboard type panel located at the ceiling with an open valance in front of it, permitting circulation of heated water in winter and chilled water in summer.

P. B. Gordon, New York, N. Y., commented that the paper touched on four separate mechanisms of interest in the field of panel cooling. One is the heat pickup by the panel; a second is the matter of lowering temperature of the structure to provide a potential heat storage; a third is the interception of heat at the barrier; and a fourth is surface temperature and comfort.

By way of discussion he asked if the author could state the calculated heat gain that would be used if the space were cooled by mechanical refrigeration. He was also interested in having any data or opinion available from the author as to what might happen to the cooled space if only the ceiling were cooled instead of the ceiling and most of the side walls.

Closure (R. R. Irwin): Professor Irwin said he would venture the opinion that in order to get results like those in the paper, it would be necessary to cool about all of the surrounding walls and not the ceiling alone because a large cooled surface would probably be needed, as the temperature difference is necessarily small. He thought that the calculated cooling load for the space was of the order of 2 tons of cooling. The rate of water circulation was 28 gpm and the rise of water temperature was from as little as 2 deg to as much as 6 or 7 deg.

The cooling tower was natural draft and was probably oversized. The range between water temperature and wet-bulb temperature probably approached 2 deg.

*Application of Climatic Data to House Design, Division of Housing Research, Housing and Home Finance Agency, Washington, D.C.

Members and guests from near and far enjoy buffet at the Oklahoma Roundup during Society's Regional Meeting

Chief Jasper Saunkeah, of the Kiowa Tribe, places war bonnet on President Haines. With this ceremony, President Haines became Chief *Gome-Pau-Tor-Keah* which in the Kiowa language means *Man Who Controls the Weather*. Also seen are Chief Saunkeah's wife and toastmaster Earle W. Gray

He felt that use of a mechanical draft tower might result in some closer approach to the wet-bulb. The water used was not treated and no operating troubles were experienced from the water, but he felt that this may have been good fortune.

He observed that one test of the adequacy of the cooling was that the apartment earned a reputation for its summer comfort and was in demand by prospective tenants. A three-quarter horsepower motor was used on the pump and he believed that it used about the equivalent of one-half horsepower. He thought that one advantage of this type of installation was its low operating cost. He also noted that the system may be used as a conventional heating system.

Chairman Gordon then turned the gavel back to President Haines who called for a recess.

AFTERNOON SESSION, SATURDAY, APRIL 16, 1:30 p.m.

After opening the session, President Haines introduced E. R. Kaiser, Cleveland, Ohio, who spoke on the subject *Whats New in ASHAE Research.*

Research Director Speaks

Mr. Kaiser outlined the nature of the 23 projects now making up the ASHAE program. Nine are at the Laboratory and 14 are at cooperating institutions. He explained how they fit into the needs of a project for design and operational information. He stressed objectives rather than methods, and made it clear that in many cases the objectives cannot be reached without long continued study. The needs for research data are increasing, problems are pressing for solutions, and he asked patience since he believed results will produce returns with a value at least double the costs.

President Haines introduced the chairman for the technical session, B. H. Jennings, Evanston, Ill., who read the rules of procedure and called on E. R. McLaughlin, University Park, Pa., to present the paper An Analysis Method of Predicting Behavior of Solid Adsorbents in Solid Sorption Dehumidifiers, by W. L. Ross and E. R. McLaughlin (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1955, pp. 169-173).

G. C. F. ASKER, Washington, D. C., (WRITTEN): The authors have pointed out that prediction of dynamic adsorption is complex and influenced by many variables.

The proposed analysis method is adaptable to behavior prediction of solid sorption dehumidifiers with stationary beds with bed depths of 2 to 8 in. and air flows used in good design practices. Table 1 of the paper gives the nominal values of test variables. It would have been of value if more tests could have been the basis for the curves used and if bed depths of ½ and 20 in. for example could have been tested also, which would give a more complete Fig. 5 in the extreme conditions. Equation 3 of the paper could be a constant in the range 25 to 120 fpm. Equa-

Tom Collins proves that "Two and Two Are Not Always Four" at Regional Banquet. Head table guests include: G. E. Ervin, Rev. T. C. Davies, Mrs. Davies, A. V. Hutchinson, Mrs. W. F. Hildebrand, P. B. Gordon, Mrs. Gray, "Chief" Haines, Tom Collins, Earle W. Gray, Mrs. Haines, John W. James, Mrs. W. J. Collins, Jr., E. R. Queer, W. J. Collins, Jr., and W. F. Hildebrand

tion 4 could in the range 2 to 8 in. bed depth be a constant and these equations might become of higher order than 1 if extreme conditions are included.

If we limit the adaptability of the test method to equipment with a bed depth of 2 to 8 in. and stationary beds, the prediction formulas can be simplified by using constants for Equations 3 and 4 without significant sacrifice of accuracy.

The paper clearly emphasizes the complex nature of dynamic adsorption and the need for further research of rate controlling factors.

The authors should be complimented for their mathematical approach to behavior prediction for solid sorption dehumidifiers.

JOHN EVERETTS, JR., Philadelphia, Pa., felt that the TAC on Sorption should be credited in the printed paper, as the project was of direct interest to that committee. He outlined how the committee has operated in getting the research work accomplished which he felt had produced the first basic design data dealing with adsorbents. He hoped that the program would continue.

G. L. SIMPSON, Pittsburgh, Pa., pointed out that 20 years ago the gross value of sales of adsorption equipment was about $1850 per year and that a designer had almost no data for use. Papers of this kind, he felt, were helping to get the application of dessicants on a sounder basis and that they would help to expand markets which are already running in millions of dollars per year.

AUTHORS' CLOSURE (E. R. McLaughlin) Professor McLaughlin stated that the performance of thin beds presents problems which may call for a new technique.

Chairman Jennings called on G. V. Parmelee, Cleveland, Ohio, to present the paper Weather Data Analysis for Cooling System Design, by G. V. Parmelee, G. E. Sullivan and A. N. Cerny (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1955).

J. P. STEWART, Syracuse, N. Y., (WRITTEN): This paper is an excellent presentation of data and a method to select design conditions for the major weather elements affecting cooling load estimates.

For New Orleans the solar radiation for Case I, for a residence or office building, was explained to be 19 percent less than the design data for clear skies published in THE GUIDE†, compared on basis of daily total solar radiation. Is the major portion of this difference due to the presence of clouds? Some care must be exercised in applying reduction factors for clouds. Table 5 shows that there were considerably more clouds or haze in the morning than in the afternoon. For Case I design conditions, the solar radiation through an East window at 8:00 a.m. would be 28 percent less than THE GUIDE design value whereas the solar radiation through a West window at 4:00 p.m. would be only 11 percent less than the value in THE GUIDE. Is this condition characteristic only of New Orleans, or do the authors think that there are generally more clouds in the morning for all areas in general?

In Table 1, the office building appears to have very little glass area because the percentage solar load is about the same as the theatre. Usually office buildings have fairly large window openings and consequently large solar loads.

Full advantage should be taken of the reduced solar radiation due to clouds in determining the total refrigeration load on a building consisting of several different exposures but the writer wonders whether it is safe to take full advantage of the clouds when selecting equipment for handling the individual zones such as the sensible heat load only on the exterior zone of office buildings where there is a very large solar load.

†HEATING, VENTILATING, AIR CONDITIONING GUIDE (published by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, New York, N.Y.).

Resolutions

WHEREAS, the first Regional Meeting of the Society under its new name ASHAE is about to be made a part of the history of the Society, and

WHEREAS, the meeting was held in Oklahoma City, capital of the Sooner state, and whose capital grounds have oil wells instead of putting greens, and located in the vicinity of the home of the world's only Will Rogers, and

WHEREAS, under the excellent direction of our Officers and Staff the aims of the Society have been much advanced through the presentation of technical papers, and

WHEREAS, the Oklahoma Chapter, through its Committee on Arrangements of which W. J. Collins, Jr., its general chairman, have provided a most entertaining program and have been solicitous of the welfare and comforts of its guests; therefore

BE IT RESOLVED that we express our sincere gratitude and thanks:

TO the Oklahoma Chapter, its officers and committees, who have made this an exceptional meeting,

TO W. J. Collins, Jr., general chairman and G. E. Ervin, chapter president, for their successful effort in conducting this meeting,

TO the hotel management who has been thoughtful of our needs and comfort,

TO the authors of the technical papers and those who participated in the discussions,

TO the ladies of Oklahoma Chapter for their wonderful hospitality to the visiting ladies,

TO Tom Collins for his humor and wit,

TO President John E. Haines, the officers and committees, and to all others who have contributed their time and efforts to insure a successful meeting.

Respectfully submitted,
The Resolutions Committee
B. H. Spurlock, Jr., *Chairman*,
Boulder, Colo.
John Everetts, Jr., Philadelphia, Pa.
W. A. Grant, Syracuse, N. Y.

It is hoped that other similar analyses can be made in the mid-west plains area, such as Dallas, Tex., and in the Great Lakes region or on the Eastern sea coast.

JOHN EVERETTS, JR., Philadelphia, Pa., pointed out that the data in the paper should be considered as a statement of how a certain type of weather data from New Orleans can be used by the designer. It is not to be considered as a collection of weather data, which is a different matter. He outlined the type of weather data in process of preparation for presentation to the Society soon. He felt that the authors might better have used wet-bulb instead of dew-point temperature in presenting their data.

AUTHORS' CLOSURE (G. V. Parmelee) Mr. Parmelee pointed out that the paper attempted to outline a method for analyzing data and to put it into a form useful to engineers. He doubted if cloudiness at New Orleans would be considered similar to that in other localities. He felt that each designer would have to decide what figures to use.

Chairman Jennings returned the meeting to President Haines who asked B. H. Spurlock, Jr., Boulder, Colo., to present the report of the Committee on Resolutions.

Following the unanimous adoption of the report, President Haines declared the session adjourned.

Entertainment

Friday afternoon 35 members and guests visited local television station WKY-TV where they learned that the television antennae is the world's tallest man-made structure. It is 1,572 ft above ground or 100 ft higher than the Empire State Building.

That evening 225 members and guests joined in an evening of pleasant relaxation consisting of a buffet supper and entertainment provided by the Oklahoma A. & M. Student Entertainment Bureau. Arranged by the local committee the program was called the Oklahoma City Roundup.

The surprise and highlight of the banquet attended by about 225 Saturday evening was when Pres. John E. Haines was made honorary Chief in the Kiowa tribe.

The ceremony was concluded by placing a beautiful feathered headpiece on Pres. Haines' head.

The talk by philosopher-humorist Tom Collins was excellent and enjoyed by everyone.

MEMBERS FEATURED ON TELEVISION PANEL

Participating in the 26th program of the *Cleveland Technical Societies* recently, G. V. Parmelee and H. R. Canoyer of ASHAE Northern Ohio Chapter participated in a television broadcast on the subject of air conditioning and the engineering back of the controls. A Bay Village High School student, Al Bruscino, and P. Bedford of Station WNBK asked the questions.

(*L. to R.*) P. Bedford, Station WNBK; A. Bruscino, Bay Village High School student; G. V. Parmelee and H. R. Canoyer, Northern Ohio Chapter.

Mr. Parmelee, in less than five minutes, explained how the controls of a gas-fired heating system perform automatically. A non-commercial film also was shown which explained the research and manufacturing processes in the making of controls and electronic equipment. At the Chapter meeting on April 11, Mr. Parmelee received high praise for his television appearance.

L. P. SAUNDERS GIVEN DEGREE BY ST. ANDREWS COLLEGE

L. P. Saunders, consulting engineer of Carmel, Calif. and his wife, Marguerite Roberta, recently received honorary degrees from St. Andrews College of London. The certificates were presented by Dr. C. S. Warn, also of California, on behalf of the college.

Mr. Saunders received a Doctor of Philosophy in Science for his work in heat control, both for private industry and the government. His wife received a degree of Doctor of Sacred Science for her own work and her assistance to her husband.

A member of the Society since 1933 Mr. Saunders was treasurer 1944-45 and a member of Council from 1941 to 1947.

STATE APPOINTMENT ACCEPTED BY J. R. HERTZLER, YORK, PA.

The appointment of J. R. Hertzler as deputy secretary of commerce was announced recently by Governor Leader of Pennsylvania. A member of the Society since 1928 Mr. Hertzler is expected to head up the department's economic development program.

Commenting on Mr. Hertzler's ability to handle this assignment Governor Leader said, *His knowledge of business methods and his wide acquaintanceship throughout industry in Pennsylvania and the nation should prove to be a substantial asset to our economic program for Pennsylvania.*

A resident of York and a native of Lancaster the former vice president of the York Corp. is well known in the air conditioning and refrigeration engineering profession. At the Society's Semi-Annual Meeting in Buck Hill Falls, June, 1934 Mr. Hertzler presented a paper, Operating Results of an Air Conditioning System Compared with Design Figures.

J. A. HOLBROOK APPOINTED TO STAFF OF CHICAGO HOSPITAL

The appointment of J. A. Holbrook as assistant director, Physical Plant, Presbyterian Hospital of the City of Chicago was announced recently by Dr. Karl S. Klicka, director.

A member of the Society since 1945, Mr. Holbrook comes to the hospital assignment from Cleveland, Ohio, where he was senior sales engineer with the Carrier Corp.

A graduate of the University of Iowa, he also is a member of the *Cleveland Society of Professional Engineers* and the *Ohio Society of Professional Engineers.*

FORMER ASHAE COUNCIL MEMBER PRESIDENT CANADIAN ENGINEERS

G. Lorne Wiggs, Montreal, Canada and a member of Council 1938-40, recently was elected president of the *Corporation of Professional Engineers* at their 36th Annual Meeting held in the City of Quebec.

A member of the Society since 1924 Mr. Wiggs heads Wiggs Walford Frost & Lindsay, Consulting Engineers. He has written a number of engineering papers and has lectured on various aspects of radiant heating and cooling, air conditioning and hot water heating in both Canada and the United States.

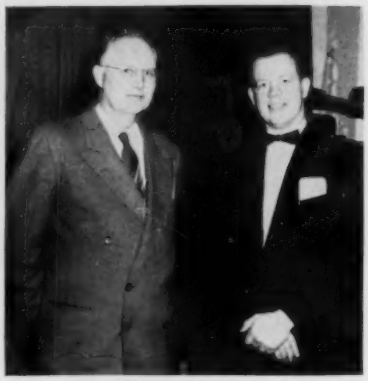
ASHAE Research Laboratory personnel visit General Electric Lighting Institute, Nela Park, Cleveland. (*l. to r.*) E. R. Kaiser, director of research; G. V. Parmelee, research supervisor; C. M. Humphreys, assistant director of research; W. Sturrock, G-E Lamp Div. Engrg. Dept.; B. Rudolph, "Mr. Edison"

Journal Section

Summary of Chapter Meetings

• *ARKANSAS*: A. J. Hess, Los Angeles, Calif., March guest speaker, discussed the *yes* of high temperature hot water heating for both industrial and commercial application. Mr. Hess diagrammed how the systems are designed and where they have been used. He noted that this type of engineering is further advanced in Europe than in the United States. Many more problems are encountered in this type of heating than in a normal low temperature hot water heating system. When Mr. Hess opened the floor to questions, he was not only asked about his subject, but also about the operation of the Society and his views on possible improvements in the Chapter program and attendance.

C. H. Miller, chairman, board of governors, suggested a change in the beginning of the Chapter calendar year from December to June. A vote will be called on this matter at the next meeting. J. W. Thompson, member, Chapters Conference Committee, reported on the Annual Meeting of the Society, and described the Regional Plan of Society Operation.



H. A. Lockhart, Morton Grove, Ill., and D. T. Donovan, assistant secretary, ASHAE, prior to Arkansas Chapter Meeting at which Mr. Lockhart spoke on "Hot Water Heating"

Arkansas Chapter officers gather before April meeting: *(l. to r.)* J. L. Brown, vice president; Fred Tenny, board of governors; W. J. Franklin, president; J. W. Thompson, secretary; C. H. Miller, R. H. Combs, and Herman Cumnock, board of governors

• *ATLANTA:* A joint meeting of the Atlanta Chapters of *ASRE* and ASHAE was held in March. Fred Johnson, Surface Combustion Corp., Columbus, Ohio, talked on *Chemical Dehumidification*, illustrating with slides showing installations of absorbents in air conditioning and industry.

The slate of 1955-56 officers presented by the nominating committee was accepted. Attendance 79.

• *BALTIMORE*: A talk on *Engineering Review of High Pressure Air Conditioning Systems* was given by R. G. Werden, industrial sales manager, York Corp., Philadelphia, Pa., at the March meeting presided over by Pres. E. H. Taze.

Mr. Werden compared the cost in three department stores of high and low pressure systems. He believed cost was governed more by the type of building rather than the type of system, as operating costs varied with each job. In conclusion, Mr. Werden showed slides illustrating various types of systems.

A nominating committee was elected prior to the talk, consisting of: E. R. Kent, E. S. Berngartt, J. H. Baker, F. M. Hewitt and S. Y. Smith. Attendance 67.

• *BRITISH COLUMBIA*: The growth of Canada's economy was covered in a talk by Pres. John E. Haines, Minneapolis, Minn., introduced by M. E. Minaker at the March meeting. Under the title, *The Next Ten Years*, President Haines also presented figures on the growth of the heating and air conditioning industry, and the Society. After forecasting the future as he saw it, he concluded by expressing his belief in the country, the future, increased efficiency and the Society. Attendance 47. Attendance ratio 0.54*.

• *CENTRAL NEW YORK*: P. B. Gordon, ASHAE second vice president, New York, N. Y. spoke on the *Regional Operation of the Chapter*, at the March meeting presided over by Pres. F. D. Putnam. Mr. Gordon, who was introduced by W. A. Grant, Syracuse, N. Y., Society council member, quoted excerpts from the Charter to emphasize the purpose of the Society, its aims and responsibilities.

Victor Cole, the second speaker, gave a very interesting talk on *Absorption Refrigeration*. A long question period followed. Attendance 48. Attendance ratio 0.20.

• *CENTRAL OHIO*: A. W. Edwards, Cincinnati, council member, explained some features of the new Regional Plan of Society Operation, at the March meeting presided over by Pres. J. A. Guy.

Interesting talks were given by Mr. Marks, Bituminous Coal Research, Inc., Pittsburgh, Pa., and Mr. McIntyre, Columbus Testing Laboratory. Attendance 39. Attendance ratio 0.30.

• *CINCINNATI*: *Automobile Air Conditioning* was the subject of an address by D. C. McCoy, Frigidaire Division, General Motors Corp., at the March meeting. Mr. McCoy was introduced by J. W. Gibbs, meetings chairman.

A nominating committee, consisting of H. E. Russell, chairman, E. W. McNamee and K. B. Little, was appointed by Pres. F. W. Wilson. Treas. T. D. Reiley reported on the treasury balance. Attendance 47.

• *CONNECTICUT*: J. A. Mulcahy, vice president in charge of sales, Bush Manufacturing Co., Hartford, Conn., spoke about new design in heat transfer products, at the March meeting. He was introduced by the presiding officer, Pres. C. L. L'Hommedieu. Attendance 57. Attendance ratio 0.30.

• *DELTA*: A joint meeting of ASHAE-*ASRE* with the New Orleans section of *ASRE* as host, was held in March under the joint chairmanship of Pres. C. V. Bankston, and C. W. Lane of *ASRE*.

B. L. Kiernan, Sr. of *ASRE* introduced the speaker, D. W. Lynch, manager-

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

engineering, Heat Pump Dept., General Electric Co., Bloomfield, N. J. Mr. Lynch's talk was entitled, *The Residential Air-To-Air Heat Pump*, and included slides and graphic presentations of the engineering problems and installations of air-to-air heat pumps. After a question period, Chairman Lane called for a vote of thanks for the speaker. Attendance 69. Attendance ratio 0.30.

• *EMPIRE STATE CAPITAL:* At the March meeting, G. G. Davis presented the guest speaker, R. K. Alexander, director of safety, Civil Aeronautics Administration, Northeastern Area. Mr. Alexander's talk on airline safety and the problems of ventilating and cooling high speed aircraft was enjoyed by all present.

During the business part of the meeting, F. R. Foote, chairman, nominating committee, announced the officers nominated by the committee. Pres. E. C. Doyle thanked R. F. Peck, chairman of the membership committee, for the excellent work of his committee. Attendance 38.

• *GOLDEN GATE:* John W. James, ASHAE first vice president, Chicago, discussed in March *Does Air Conditioning Provide a Healthful Indoor Environment?* Members were interested in his appreciation of the future of the heating and air conditioning profession. Attendance 38.

• *GOLDEN GATE:* The speaker at the February meeting presided over by Pres. Eric Roberts was Dan Galloway, western district manager, Industrial Sound Control, Inc., Hartford, Conn. Mr. Galloway, introduced by D. E. McLeod, gave an interesting and informative talk on noise control. Attendance 66.

• *ILLINOIS:* At the March meeting, a Life Membership Certificate was presented by C. W. Johnson to D. B. Scheidecker. Pres. G. V. Zintel presided and announced the election of G. V. Zintel, H. G. Gragg, H. E. Anderson, E. P. Heckel, Jr., H. Kreisman, R. O. Nelson and M. J. Bamond were elected to the nominating committee.

After the close of the business session, W. N. Barr, Jr. of the meetings committee introduced the speaker, C. W. Nessell, account executive, Minneapolis-Honeywell Regulator Co., Chicago, Ill. Mr. Nessell, an ASHAE member and chairman of the field investigation committee for the National Warm Air Heating and Air Conditioning Association, spoke on *What is the Latest in Residential Air Conditioning?* He used the data from his committee's research village in Austin, Tex., which showed that many of the faults attributed to air-conditioning systems were more directly attributable to the quality of installation. He emphasized that much greater care must be taken, especially in slab installations. Mr. Nessell mentioned some practical points, which, when substantiated by field findings, would prove of great help to installers. A lively question period followed. Attendance 160.

• *INDIANA:* A joint meeting was held in March with the Indiana section of *ASRE*, with *ASRE* president, J. W. Ludewig, presiding. President Ludewig welcomed ASHAE chapter president, P. O. Patterson who introduced in turn F. B. Morse. Mr. Morse made known to the meeting student branch officers D. B. Doucette, president and J. W. Deabler, secretary.

ASHAE Program Chairman, J. M. Teskoski, presented the *ASRE* Program Chairman, E. N. Kerrigan. The speaker, introduced by Mr. Kerrigan was H. E. Degler, technical director, The Marley Co., Kansas City, Mo., who spoke on *Water*.

Mr. Degler explained the alternate 11-year wet and dry cycles, saying the present dry cycle should continue until 1962. He showed slides illustrating the use of cooling towers, and his talk was followed by a lively question period.

• *INLAND EMPIRE:* After Max Tonn, secretary, had read the minutes of the February meeting, Pres. H. A. Bickel appointed a nominating committee of L. E. Marque, chairman; R. C. Schmidt, J. L. Harvey, and R. E. Shanks, at the March meeting of the chapter.

ASHAE Pres. John E. Haines, introduced by the Chapter Vice Pres., F. W. Jenkinson, gave a very interesting talk on the future of the Great Northwest, and pointed out the advancements the heating and air conditioning profession has made in the last 10 years. He listed what might be expected in the next 10 years. When discussing the Society's plans for the future, he showed educational slides.

• *IOWA:* The March meeting was held in conjunction with the Electrical-Mechanical-Railroad section of the Iowa Engineering Co. Presiding officer was Pres. W. E. Nanes. After a social hour and dinner, members and guests listened to two speakers.

Patents Are a Fascinating and Important Part of All Manufacturing was the title of a talk given by R. H. Olsen, senior partner, Olsen & Trexler Patent Firm, Chicago, Ill. He was followed by H. G. Hershey, past president, *Iowa Engineering Society*, who spoke on *How Can Technical Societies Use the Iowa Engineering Society?* The meeting adjourned after a short discussion period.

• *IOWA:* Pres. Maurice Olchoff of the *ASME* Central Iowa Section presided over the Iowa Chapter of ASHAE for their February joint meeting. Speaker for the evening was D. C. McCoy, technical consultant for the general sales manager's staff, Frigidaire Division, General Motors Corp. Mr. McCoy spoke on the design problems encountered in adapting conventional air conditioning systems to the automobile.

Mr. McCoy pointed out the great advance made in reliability of performance, weight reduction and reduction of primary costs of air conditioning equipment for automobiles. He predicted a great future for this field.

Journal Section

• *KANSAS:* Pres. Charles Yoe presided over the March 8 meeting of the Kansas Chapter. After the business meeting, Vice Pres. A. B. Newton introduced the speaker, George Nafe, manager, sales service section, Century Electric Co., St. Louis, Mo. Mr. Nafe spoke on *Air Conditioning Demands on Electric Motors*. Attendance 32.

• *KANSAS CITY:* The March meeting featured a discussion on *Rating and Performance of Domestic Warm Air Heating Equipment* by O. J. Ress, chief engineer, Mueller Climatrol, Division of Worthington Corp., Milwaukee, Wis. Vice Pres. A. S. Hurt, Jr. introduced the speaker. Attendance 66. Attendance ratio 0.22.

• *MANITOBA:* An interesting March talk on the proposed skyway for Winnipeg was given by Harry Burns, City of Winnipeg Traffic Engineer. Mr. Burns, who was introduced by P. L. Charles, received so many interesting questions on his talk, that the discussion was considerably prolonged. He received a vote of thanks from Ernest Lambert. The presiding officer was A. J. McIntyre, secretary, in the absence of Pres. G. T. Christie. Attendance 15.

• *MIAMI VALLEY:* A speech on *High Temperature High Pressure Hot Water Heating Systems* was given by R. A. Metz, American Hydrotherm Corp., Long Island City, N. Y. at the March meeting, presided over by Pres. R. W. Kimmel.

Making the point that high pressure hot water is safer than high pressure steam, if there is a rupture in the distribution system, Mr. Metz added that in certain installations there is a saving of from 20 to 40 percent on the high pressure water system as compared to steam systems. D. E. Tullis thanked Mr. Metz for his presentation and the meeting was adjourned. Attendance 58.

• *MICHIGAN:* John W. James, ASHAE first vice president, Chicago, Ill., spoke on *Activities of the American Society of Heating and Air-Conditioning Engineers*, at the March dinner and meeting, presided over by Pres. E. F. Glanz.

The main event at the business meeting after the dinner was a panel discussion on *Relations Between Architects and Engineers*. Panel members were: T. J. Black, P.E., J. B. Olivieri, P.E., C. D. Hannan, *A.I.A.* and J. W. Leinweber, *A.I.A.* The four speakers discussed methods of improving cooperation between architects and engineers in regard to coordination of work, space provisions for mechanical equipment, fees and ethics. Attendance 130.

• *MINNESOTA:* In March, J. S. Locke introduced Prof. R. C. Jordan, head, department of mechanical engineering, Uni-

versity of Minnesota, Minneapolis, Minn., who spoke on *Solar Energy and the Heat Pump.*

The nominating committee for the 1955-56 officers was elected as follows: A. B. Algren, E. F. Snyder, Jr., R. J. Ruth, Ron Gredley and V. E. Pearson. Attendance 131.

• *MISSISSIPPI:* B. L. Palmer introduced the guest speaker at the March meeting, R. A. Gonzalez, director of application engineering and sales training, Airtemp Division, Chrysler Corp., Dayton, Ohio. Mr. Gonzalez presented a stimulating program on *Air-Cooled Air-Conditioning Equipment.* Pres. J. E. Davis, Jr. presided. Attendance 46.

•*MONTREAL:* Contending that the air conditioning profession has a brilliant future, John W. James, ASHAE first vice president, Chicago, Ill. spoke at the March meeting on *Does Air Conditioning Provide a Healthful Indoor Environment?* Mr. James, introduced by F. A. Hamlet, said control of temperature humidity, and movement of air is a very important factor for man's comfort, since he spends 88 percent of his time in an artificial environment. R. J. Ker thanked the speaker and the meeting was presided over by Pres. D. C. Lindsay.

• *NEBRASKA:* John W. James, ASHAE vice president, Chicago, introduced in March by M. F. Stober, posed the question *Does Air Conditioning Provide a Healthful Indoor Environment?* The attendance at the meeting and the comments following Vice President James' talk indicated tremendous interest in the topic. Pres. C. A. Goth presided.

• *NEW MEXICO*: *Temperature Controls* was the subject of N. J. Janisse, field engineer, Johnson Service Co., Milwaukee, Wis., who spoke at the April meeting.

Following a discussion by H. F. Munn of the proposed changes in the Constitution of Technical Societies, a motion for their adoption passed unanimously. The nominating committee report was read along with those for membership, attendance, publicity and the treasurer's report. Attendance 50.

• *NEW YORK*: The effect of heat storage in the floor, walls and ceiling upon the maximum heat load was illustrated with charts by G. V. Parmelee, senior research supervisor, ASHAE Research Laboratory, Cleveland, at the March meeting. His subject was the *Effect of Heat Storage Capacity of Buildings on Air-Conditioning Loads.* Mr. Parmelee, who was introduced by Albert Giannini, program chairman, discussed methods of lowering the peak load and the relation of the actual to the computed heat load. The effect of different types of operation were shown on charts. The possibilities of the methods of circuit analysis as a means of studying the effect of the different elements of heat load were also shown.

Pres. R. L. Stinard appointed an auditing committee, consisting of Ernst Graber, chairman, Sherman Loud and H. G. Junger; and the board of tellers with J. P. Lyon as chairman, L. D. Carr and H. N. Seelinger. Attendance 80.

• *NORTH JERSEY:* At a point *ASRE*-ASHAE meeting held in March, questionnaire cards were given to those in attendance to determine the points of greatest interest in the subject for discussion, *Year-Round Residential Air Conditioning.* The panel consisted of C. M. toeLaer, F. B. Seel and W. R. Dwyer.

There were several expressions of interest in continuing the practices of holding joint meetings every year.

H. S. Wheller, on behalf of the nominating committee, offered a list of nominees for 1955 officers. Attendance 184.

Annual Meeting to be held in Kansas City. A unanimous motion by the Northeastern Oklahoma Chapter so approved. Guests from Oklahoma City made comments supporting the Oklahoma Regional Meeting.

The guest speaker, C. D. Adams, Jr., commercial branch manager, Minneapolis-Honeywell Regulator Co., Houston, Tex., presented an interesting talk on *Electronic Controls.* Attendance 40. Attendance ratio 0.54.

• *NORTHERN OHIO*: J. R. Venning introduced the March meeting speaker, John Schenk, director of engineering, Alco Valve Co., St. Louis, Mo. Mr. Schenk illustrated the application technique in the use of thermal expansion valves and suction line pressure regulators for balancing refrigeration systems.

Pres. D. E. Mannen expressed the Chapter's appreciation to the entertainment committee for the theatre party. A letter from Fenn College announcing Engineers Career Day was read. Attendance 65.

NORTHERN PIEDMONT — Recently elected officers are: (*l.* to *r.*), D. T. Waynick, treasurer, James Johnson, York, Pa., speaker; S. T. Oliver, president; L. R. Gorrell, vice president; and C. A. Cofer, program chairman. The March meeting was addressed by Dr. J. D. Watson, Watson & Hart, Engineers of Greensboro, speaking on the *Water Resources of North Carolina.* He was introduced by Program Chairman A. C. Cofer. W. D. Graham, Jr. presided in the absence of Pres. S. T. Oliver.

• *NORTH TEXAS*: N. A. Cole, *National Association of Home Builders,* Austin, Tex., spoke at the March meeting on the development, installation and operational experience of 22 air-conditioned residences in a housing development in Austin, Tex. Mr. Cole summarized the installations, and told how comfort conditions were achieved. He emphasized that the installations were all made with low operating cost, and were purposely undersized in compressor capacity based on generally accepted capacity requirements. A lengthy question period followed. Presiding officer was Vice Pres. J. A. Ray. Attendance 145. Attendance ratio 0.51.

• *NORTHEASTERN OKLAHOMA:* Pres. J. T. McKinney announced at the March meeting that he had received a letter from the Kansas City Chapter recommending endorsement of their bid for the 1960

• *OKLAHOMA:* At the March meeting a report on the plans for the Oklahoma Regional Meeting was made by W. J. Collins, Jr., general chairman of the Committee on Arrangements, following the election of a nominating committee consisting of G. T. Donceel, chairman; P. F. Oller and F. X. Loeffler, Jr.

A speech on *Design and Performance of Waterless Air Conditioning* was given by R. W. Kelto, Airtemp Div., Chrysler Corp., Dayton, Ohio. He emphasized *comfort conditions* for the users of this type of air conditioning and compared its cost with water cooled air conditioning. The meeting was presided over by Pres. G. E. Ervin. Attendance 76. Attendance ratio 0.50.

• *ONTARIO*: Dr. Marcus Long, professor of philosophy, University of Toronto, spoke at the March meeting on *The Things That*

F. PAUL ANDERSON AWARD

The Committee of Award for the F. Paul Anderson Medal announces that nominations for the F. Paul Anderson Medal for 1955 are invited. Any member of the Society is eligible for nomination. The award is made in recognition of work done or service performed in the field of heating, ventilating or air conditioning.

Nominations, together with a full statement of the candidates' qualifications and achievements, should be sent to the Committee at ASHAE Headquarters, 62 Worth St., New York 13, N.Y., prior to August 1, 1955.

F. PAUL ANDERSON COMMITTEE
JOHN W. JAMES, *Chairman*
LESTER T. AVERY — E. P. HECKEL
P. D. GAYMAN — REG. F. TAYLOR

Matter. His stimulating speech was very much appreciated by his audience. Dr. Long was introduced by W. L. Rootham and the meeting was presided over by Pres. M. C. Bailey. Attendance 77.

• *OTTAWA VALLEY*: John W. James, ASHAE vice president, Chicago, Ill., spoke on the *Indoor Climate*, at the March meeting, Pres. W. J. Robinson presiding.

Vice President James defined *indoor climate*, and discussed five of its health aspects, heating, cooling, moisture, air quality and controls. He illustrated his talk by the use of charts, and emphasized that only the rich can afford poor heating. He was thanked by C. H. Schock. Attendance 28. Attendance ratio 0.40.

• *PHILADELPHIA*: *Discussion of Fans & Blowers* was the title of a talk given at the March meeting by H. D. Diffenbaugh, manager, fan department, American Blower Corp., Detroit, Mich. The speaker, who was introduced by C. W. Lubking, program chairman, illustrated his talk with slides. Pres. Lloyd M. Church presided. Attendance 97. Attendance ratio 0.30.

• *PITTSBURGH*: A panel on *How Should Temporary Heat Be Specified?* was held at the March meeting, presided over by Pres. E. C. Hach. Moderator of the panel was T. F. Rockwell, and speakers were: C. S. Ingham, architect, Ingham, Boyd & Pratt, R. J. Mitchell, The Trimble Co., and A. F. Nass, president, McGinnis, Smith & McGinnis Co., all of Pittsburgh, Pa.

Mr. Ingham gave his views on the specifications of temporary heat, and the difficulties encountered in changes in conditions and types of buildings, in regard to ownership. The second speaker, Mr. Mitchell, outlined the work of a general contractor, and the third, Mr. Nass, spoke of the work of a heating contractor, and his relationship with the unions. A general discussion followed. Attendance 75.

• *ROCKY MOUNTAIN:* F. E. Stark was introduced by the presiding officer, Pres. V. F. Vallero, at the March meeting, as vice president to complete the unexpired term of F. C. Allen, former vice president of the chapter.

The speaker for the evening was Fred Riehl, Public Service Co., Colorado. He was introduced by F. E. Stark and spoke on his theoretical *Method for Sizing Cooling Towers.*

• *SACRAMENTO VALLEY*: Speaking at the March meeting, John W. James, Society vice president, Chicago, Ill., pointed out that while air conditioning in certain applications is essential for good health, on the whole it has not been proven to be necessary. Introduced by Sacramento Valley Vice Pres. R. A. Sarro, Vice President James proposed answers to the question *Does Air Conditioning Provide a Healthful Environment?* Until the medical profession more clearly establishes the relation between air conditioning and health, Vice President James concluded that air conditioning will have to be justified on the basis of comfort, convenience, safety and economy.

Eric Roberts, president, Golden Gate Chapter, extended an invitation to everyone to attend the Semi-Annual Meeting in San Francisco, June 27-29. Pres. J. E. Marshall presided. Attendance 47. Attendance ratio 0.41.

• *ST. LOUIS*: Pres. G. H. Bemarkt opened a series of reports on the 1955 Annual Meeting which was given at the St. Louis March meeting. President Bemarkt named the St. Louis Chapter members whom he had seen in Philadelphia, and outlined the Regional Plan of Society Operation. G. W. F. Myers noted the excellent attendance at the Meeting and technical sessions, expressing belief that the greater emphasis on woman's place at the meetings is a major factor in increased attendance. A description of the post-meeting Bermuda trip was given by H. C. Sharp. B. L. Evans spoke briefly on the Oklahoma Regional Meeting, as well as on the Annual Meeting.

G. W. F. Myers was appointed by President Bemarkt as chairman of the nominating committee with H. J. Kipp as a member. Elected to the committee were B. C. Simons, M. J. Collins, Jr. and N. J. Hubbuch, Jr.

Vibration and Noise Control of Air-Conditioning Equipment was the subject of a speech by D. H. Vance, vice president and executive engineer, Korfund Co., Inc., Long Island City, N. Y. E. T. Clucas, meetings committee chairman, introduced the speaker. Mr. Vance stated that the problem of vibration is constantly increasing due to increasing compressor speeds. He said that the aim is to eliminate the lowest frequency vibration, since higher harmonics would then automatically disappear. Mr. Vance described various types of vibration eliminators, particularly cork, rubber and springs. According to the speaker, springs are considered the best type, preferably without snubbing. Mr. Vance proved himself to be thoroughly acquainted with his subject. Attendance 38.

• *ST. LOUIS*: The Engineers Club of St. Louis and the *ASRE* St. Louis Section combined with the ASHAE St. Louis Chapter for a meeting in February at the club house of the Engineers Club. Henry Miller, president, Engineers Club, welcomed the members and introduced the officers of the two visiting societies. He outlined the program for National Engineers Week and introduced Professor Bolstead, University of Missouri, who announced that an air conditioning conference was to be held at the University.

E. T. Clucas, ASHAE program chairman, introduced the speaker, Allen Wilson, director of merchandising, Burgess-Manning Co., Chicago, Ill., who was assisted by W. C. Kadow, liaison engineer of the same company. Mr. Wilson reminded his audience that the ultimate objective of heating and air conditioning is the production of human comfort, and that, in his opinion, this fact is given too little emphasis in an attempt to attain some specific temperature or humidity condition. He brought out the fact that THE GUIDE states that a person is comfortable when dissipating 60 percent of the body heat by radiation, 20 percent by convection and 20 percent by evaporation, and therefore, concluded that more attention should be paid to this loss by radiation. His final assertion was that radiant heating results in a more healthful condition.

Mr. Kadow spoke on the technical aspects of the metal radiant heating panel. He stated that the rate of heat emission from the panel is determined by dividing the heat loss from the room by the room area and that the water temperature is fixed by the panel with the highest rate of emission. He warned against overdesigning a system, and specified that ventilation air should be supplied at a constant volume and temperature.

Following a question and answer period, refreshments were served. Attendance 101.

• *SOUTH TEXAS*: The program for the February meeting consisted of a panel report by members who had attended the Annual Meeting in Philadelphia. Reg. F. Taylor told of developments in the Council.

Journal Section

I. A. Naman reported on the TAC on Cooling Load; J. C. Lewis, on the Chapters Conference Committee meeting; C. L. Fleming, on the activities aboard the train to Philadelphia.

Pres. J. W. Holland read a letter from L. N. Hunter, past Society president, and one from E. B. Appling, regarding air conditioning equipment standards and public relations. Attendance 59.

• *SOUTHERN CALIFORNIA*: Honored guest at the March meeting, ASHAE Pres. John E. Haines, Minneapolis, Minn., spoke on *The Next Ten Years*. J. R. Hall, program chairman, introduced President Haines, who outlined the history of the Society together with the growth and importance of the Society in the profession. He reviewed the tremendous development and increase in product sales and value in the past 10 years. Predictions were made on the increased scope of ASHAE activities in the next 10 years together with the increased value and sales of products allied with the profession. It was stated that Society research sets principles which are basic in that they can be used with confidence. At the conclusion of his excellent presentation President Haines was given a standing ovation.

A. J. Hess, chairman of the nominating committee, presented the recommended slate of officers for the 1955-56 term. Pres. C. D. Walz read a suggested amendment to the Chapter by-laws. Attendance 112.

• *SOUTHERN CALIFORNIA*: *New Horizons in Air Conditioning* was the subject of the February talk by L. M. K. Boelter, dean, College of Engineering, University of California. J. R. Hall, program chairman introduced the speaker. Dr. Boelter treated the world-wide problem of air pollution, mentioning 10 communities in the world which are reaching the end of their available air resource. Discussing the causes of smog, he suggested that ASHAE maintain a study group to work with the medical profession and local authorities interested in combating air pollution. Dr. Boelter said that the use of solar energy in the southwest promises to reduce air pollution by the use of solar heaters. He concluded that present air pollution problems spell a challenge to all and must be met with further research. A great number of questions following the talk indicated the members' interest.

H. B. Nottage, chairman, committee on codes and standards, presented an excellent report on the discussion of fire prevention, fire shutters, fire dampers and corridor returns held at the Engineers Club in January. Pres. C. D. Walz commented on the highlights of his trip to the Annual Meeting. The following were elected to the nominating committee: A. J. Hess, temporary chairman, W. O. Stewart, J. S. Earhart, J. F. Park and E. C. Evans. Attendance 79.

• *SOUTHERN PIEDMONT*: J. R. Clark, program chairman, presented the speaker at the March meeting, R. E. Mason, R. E. Mason & Co., Charlotte, N. C. Mr. Mason showed a film entitled *Fluid Mixing*. Attendance 21. Attendance ratio 0.22.

• *SOUTHERN PIEDMONT*: Pres. L. F. Lawrence reported on the chairmen and members of the various committees recently appointed. Listed at the February meeting were the following chairmen: *Nominating*—L. F. Lawrence; Auditing—S. B. Blanton; *Membership*—R. O. McGary; *Attendance and Reception*—D. L. Howard; *Publicity*—C. E. Petty; *Finance*—C. M. Setzer, Jr.; *Program and Special Events Committees*—J. R. Clark. A change in the by-laws, allowing dues for Junior Members to be reduced, was carried.

J. R. Clark introduced the speaker, D. H. Vance, vice president and executive engineer, Korfund Co., Inc., Long Island City, N. Y., who spoke on *Vibration and Noise Control for Air-Conditioning Equipment*. Attendance 35. Attendance ratio 0.27.

• *TOLEDO*: Robert Greenwald, delegate to the *Toledo Technical Council*, reported at the March meeting on Engineers Week, stating that Toledo Chapter's candidate had placed second in the choice of an Outstanding Engineer. Mr. Greenwald introduced E. R. Kaiser, director of ASHAE research, Cleveland, who described 23 different projects now under study.

A nominating committee of three was elected including J. S. Meyer, G. W. Bleckner and J. P. Eyster. Attendance 39.

• *TOLEDO*: *High Pressure, High Velocity Air Distribution* was the subject of a talk in February by C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N. Y. J. P. Eyster introduced Mr. Wilson.

Pres. F. C. Richardson, Jr. commented on the Annual Meeting in Philadelphia. W. D. McKitrick was elected as Toledo Chapter's candidate for Outstanding Engineer, in connection with Engineers Week.

• *UTAH*: A tour of Hill Field Air Force Base was conducted at the March meeting. Members and guests were greeted by Captain Teal, public information department. The group was conducted around the Base and to the various installations, which were described by Riley Heath, head, heating and air-conditioning section, base maintenance office. Several types of heating systems were observed at the nine different installations visited. Huge three and four million Btu indirect-fired high volume heaters seem to do an exceptionally good job of hangar heating due to the large volume of air handled at low temperatures. An unusual installation that highlights the ingenuity of Air Force installations is the water tube boiler installed in an abandoned parachute well, the only space available. A concrete platform was erected 20 ft in the air in order to hold the boiler without occupying floor space. At the conclusion of the tour, Mr. Heath answered questions about factors determining choice of fuel and methods of heating.

Vice Pres. R. C. Evans presided at the business meeting. Following the reading of the nominating committee report by Secy. W. L. Stuewe, Vice President Evans announced that ASHAE Vice Pres. John W. James, Chicago, Ill., would be the featured speaker at the banquet terminating the Second Annual Conference on Heating and Ventilating. He urged the members to present papers or enter displays at this conference. Attendance 14. Attendance ratio 0.14.

• *UTAH*: Problems encountered in residential, industrial and high velocity air distribution were discussed by a panel, consisting of J. L. Ashton, E. V. Gritton and Paul Huber, with D. R. Wilde as moderator, at the February meeting. R. C. Evans introduced the program, which was entitled *Air Distribution*.

William Barnes, professor, mechanical engineering department, University of Utah, introduced by Pres. A. A. Maycock, previewed the Second Annual Conference on Heating and Ventilating, sponsored by the University of Utah in cooperation with *ASME* and ASHAE.

President Maycock announced the selection of the following nominating committee: J. L. Margetts, chairman, A. R. Curtis and G. E. Wright, Jr. Attendance 30.

• *VIRGINIA*: A non-technical speech on *Christianity in Business* was given by H. H. Ross, Monarch Life Insurance Co., at the March meeting. A. B. Miller presented the speaker.

C. G. Conaway, Jr. reported on the Chapters Conference Committee meeting at the Annual Meeting in Philadelphia. Attendance 25. Attendance ratio 0.28.

• *WASHINGTON, D. C.*: G. C. F. Asker, president of the Washington, D. C. Chapter and vice president, Daly, Merritt & Sullivan, Inc., Falls Church, Va., discussed the importance of proper moisture control at the March meeting. He mentioned various systems of dehumidification, listing the advantages and disadvantages of each. His talk covered load calculations and design problems encountered.

P. R. Achenbach, member, Chapters Conference Committee, reported on the Committee meeting in Philadelphia. The chairman of the nominating committee, S. R. Allen, announced the committee's nominees for the 1955-56 year. Proposed amendments to the Chapter by-laws were adopted. Attendance 56. Attendance ratio 0.37.

• *WEST TEXAS*: Gas combustion was the subject of a talk in March by Robert Read, design and engineering consultant,

John Zink Co., Tulsa, Okla. V. B. Garry introduced the speaker.

A proposed amendment to the chapter by-laws regarding ethics was tabled. R. L. Mason discussed encouraging student membership in the Society. Attendance 17. Attendance ratio 0.33.

• *WESTERN MICHIGAN*: E. R. Kaiser, director of ASHAE research, Cleveland, reviewed the aims and purposes of the Society at the March meeting. He mentioned several ASHAE committees, noting that Western Michigan Chapter members played important parts on these committees. Mr. Kaiser explained that the Research Laboratory studies certain phases of the profession, such as research conducted on weather conditions throughout the United States, which prove helpful to the manufacturer, contractor and design engineer. In covering heating and cooling load calculations, the speaker mentioned that the insulating factor has been revised. Mr. Kaiser also spoke of various current projects: the problem of heat flow through glass, the study of shading and venetian blinds, and projects on infiltration. Air filters, odor control, tests on air friction, air noise, oil burner pulsation problems, and comfortable temperatures were also treated in the range of Mr. Kaiser's discussion. H. R. Limbacher introduced the speaker.

Pres. F. W. Brundage appointed C. H. Pesterfield, N. A. Buckley and William Wessels as a nominating committee, and K. L. Lamm to fill a vacancy on the auditing committee.

• *WISCONSIN*: Vice Pres. I. J. Rossiter initiated the introductions of the large number of visiting engineers present at the March meeting. J. E. Schackton, guest speaker, told his audience that the responsibility for a successful job depends upon the proper selection of motor controls, which is basically simple. Mr. Shackton elaborated on motor starters, covering their functions, the manual and magnetic classes of starters, and different types of magnetic starters. He also discussed relays and enclosures.

Pres. L. C. Plaehn read the report of the Chapters Conference Committee meeting in Philadelphia, by J. A. Lofte, Committee Member. President Plaehn announced the nominating committee: N. E. Hill, chairman, Mr. Lofte, and F. W. Goldsmith. Attendance 101. Attendance ratio 0.33.

Journal Section

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 96 applications for membership, including 4 reinstatements; in addition 14 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by June 30, 1955, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arkansas

BAILEY, N. W., Pres., Ozark Insulation Co., Inc., Little Rock. REFERENCES: R. E. Blaylock, G. S. Daunis, Maury Hughes, Jr., G. M. Rozzell, Jr.

California

BAXTER, R. L., Appl. Engr., Preferred Equipment, Inc., Los Angeles. REFERENCES: J. S. Earhart, Carl Raymond, K. D. Simon, R. C. Taylor.

BUTLER, O. M., Sales Mgr., Bush Manufacturing Co., Riverside. REFERENCES: K. M. Baker, J. W. Craig, K. D. Simon, R. C. Taylor.

CLARK, W. T., Vice Pres., York Pacific Co., Sacramento. REFERENCES: Frank Hamilton*, A. L. Hughes, R. M. Oeberst*, C. S. Sowers*.

DUNCAN, M. N., Dist. Mgr., Penn Controls, Inc., Berkeley. REFERENCES: H. R. Bissell, Jr., W. M. Lewis, R. N. Poage, R. R. Taylor.

FARMER, W. F., Pres., Wm. F. Farmer Co., Berkeley. REFERENCES: K. W. Brown*, J. D. Gratiot, H. V. Hickman, Don Ralston*.

GILLESPIE, H. E., Sales Engr., Dust Control Inc., Hawthorne. REFERENCES: K. B. Baker, C. W. Finn, E. R. Hicks, R. A. Yates.

KASTELIC, W. R., Pres., Sunset Heating & Air Conditioning Co., Inc., Menlo Park. REFERENCES: C. F. Larson, R. R. Taylor, R. G. Tuck, Albert West.

STUDYBAKER, J. H., Serv. Repr., Sacramento Municipal Utility District, Sacramento. REFERENCES: A. M. Banchero, J. E. Day, J. C. Jerde, R. E. Williams.

Colorado

THIXTON, C. E. Airflow Engineering Co., Pueblo. REFERENCES: W. B. Levin, Murial Murray*, George Nitchy*, J. W. Norris*.

Connecticut

LA RIVIERE, H. E., Foreman, Scovill Manufacturing Co., Waterbury. REFERENCES: Arthur Chaffee*, T. W. Colina*, Joseph Salmini*, Robert Weber*.

PAULICK, J. E., JR., Sales Engr., American Blower Corp., New Haven. REFERENCES: J. W. Brinton, W. E. Heibel, R. J. Lorenzi, Winfield Roeder.

District of Columbia

CASS, L. D., Mech. Engr., Heffron Co., Inc., Washington. REFERENCES: J. J. Chaconas, Sr., John Lackler*, Daniel Seganish*, M. E. Weschler*.

Florida

MCGEE, T. A., Htg. & Air Cond. Engr., McCall Fuel Corp., Jacksonville. REFERENCES: W. H. Byrne*, L. B. Landes*, J. D. Mattimore, Eugene Molloy*.

Illinois

△GAGE, E. H., Engr., S. J. Reynolds Co., Inc., Chicago. REFERENCES: H. G. Chapin, H. C. Stevens, L. H. Streb, G. V. Zintel.

HIRSCH, P. R., Mech. Engr., Leonard Construction Co., Chicago. REFERENCES: R. S. Blumenthal, I. B. Kaiser, I. S. Kaiser, R. W. Stewart.

†ORAVETZ, J. A., Chief Engr., U.S. Government Engineering Dept., Fort Sheridan. REFERENCES: H. B. Nellons*, T. W. Nelson*, F. E. Nusbaumer*, W. P. Wilkey*.

Journal Section

△RAPPEL, R. L., Vice Pres., Fettes, Love & Sieben, Chicago. REFERENCES: W. S. Bodinus, J. S. Kearney, W. A. Kuechenberg, R. O. Nelson.

STATEMAN, H. F., Engr., Sunbeam Service Co., Brookfield. REFERENCES: H. H. Aronson, W. N. Barr, Jr., E. N. Patek, W. G. Pennington.

Indiana

†NYLAND, J. A., Owner, Nyland Sheet Metal Co., Indianapolis. REFERENCES: S. E. Fenstermaker, J. T. Hardin, G. B. Supple, G. W. Vogel.

Iowa

POLLY, V. G., Engr., Keating Fuel Equipment Co., Des Moines. REFERENCES: J. R. Bain, J. F. Sandfort, D. E. Schroeder, D. E. Wells.

Kentucky

CARR, H. J., Sales Repr., General Electric Co., Louisville. REFERENCES: F. H. Faust, G. K. Iwashita, J. A. Lamb, C. J. Rigby.

Louisiana

CRIBBS, H. H., Pres., Harvey H. Cribbs Roofing & Sheet Metal Co., Inc., Baton Rouge. REFERENCES: R. K. Goode, J. F. Naylor, Jr., W. I. Pol, C. S. Woodruff.

FREDERICK, E. C., Estimator, Airtrol Engineering Co., Baton Rouge. REFERENCES: R. K. Goode, A. W. Holland, W. I. Pol, C. S. Woodruff.

GUTH, J. J., JR., Chief Mech. Engr., Carl M. Hadra Assocs., Shreveport. REFERENCES: C. M. Hadra, J. S. Malahy, R. S. Segall, R. F. Zimmerman.

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Journal Section

OBITUARIES

EDWARD B. JOHNSON
New York, N. Y.

E. B. Johnson, heating consultant, 74, died on April 21. A Life Member of the Society for the past five years, Mr. Johnson had been elected a Member in 1919. He was secretary of the New York Chapter, 1922-29.

E. B. Johnson

Mr. Johnson, who was born in Morristown, N. J., on October 30, 1880, attended New York City public schools. He was graduated from Cooper Union with a B.S. in 1903, receiving a postgraduate C.E. degree 10 years later.

After graduation, he spent two years with the Rodman Rapid Transit Commission, New York City, making field surveys, drafting and computing for the first subway in the city. He was in charge of wash borings made for future subway extension along 4th Avenue, Brooklyn. In 1905, he went with the Board of Water Supply, doing instrument work on preliminary surveys. For the next 10 years, he worked on topographical surveys of the borough of Richmond, as transitman in charge of the field party and then as assistant engineer in charge of the division office.

There followed a long period as sales engineer for two New York companies, 10 years with the American Radiator and Standard Sanitary Corp., and 15 years with the Staten Island Supply Co. Later, he joined Parsons, Brinckerhoff, Hall and MacDonald as designer and mechanical engineer. Mr. Johnson worked on designing the heating plants for the U. S. Government Army Engineers Buildings at Harmon Field and Keflavik, Iceland Air Fields. Previous to his death, he did private consulting work.

GEORGE E. PERRAS
Montreal, Que., Can.

The news of the sudden death of George E. Perras, Montreal, Que., has reached the Society. Mr. Perras died on March 7, 1955 at the age of 61. He joined the Society in 1936.

Born in Thurso, Que., on April 17, 1893, Mr. Perras began his career as a heating apprentice for McKinley & Northwood, Ottawa, Ont. in 1910. He later successively became a district superintendent, W. G. Edge, Ltd., Montreal; sales representative, Empire Brass Manufacturing Co., Ltd., London, Ont.; and designer, general superintendent and estimator, Thomas O'Connell, Ltd., Montreal.

In 1932, he entered the employ of Thomas Robertson & Co., Ltd., also of Montreal, and remained with them except for a brief interval in 1948-49 when he acted as vice president of Galarneau & Perras, Montreal. At the time of his death, he was manager, heating department, Thomas Robertson Division, Empire Brass Manufacturing Co., Ltd.

FRED J. SCHERGER
Detroit, Mich.

Fred J. Scherger, sales engineer, Mundet Cork Corp., Detroit, Mich., died on April 18 at the age of 56. Mr. Scherger had been a sales engineer in charge of heat insulation, working on estimating, consulting and sales since 1934.

Born on October 31, 1898 in Tiffin, Ohio, Mr. Scherger attended St. John's High School and received his A. B. from St. John's College, Toledo, Ohio in 1919. Five years later he received a B.M.E from the University of Detroit. Previous to joining Mundet Corp., he was connected with Harrigan & Reid Co., Detroit, estimating, consulting and doing layout on heating and ventilating systems.

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(60 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES., W. A. Biddle, 3817 N. 15th Ave. SECY., E. P. Maxwell, 39 W. Adams St.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, 3rd Tues. PRES., W. J. Franklin, 608 W. Third St. SECY., J. W. Thompson, 1314 Main St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, 2nd Mon., PRES., T. A. Barrow, Jr., 735 Spring St., N.W. SECY., J. A. Marshall, 1415 Howell Mill Rd., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, 3rd Wed. PRES., E. H. Taze, 33 E. 21st St. (18). SECY., R. F. Weisman, 4650 Reisterstown Rd. (15).

● **BLUEGRASS:** 1954. Hdqrs., Louisville, Ky. Meets, 2nd Mon. PRES., J. W. May, 215 Central Ave. SECY., A. E. Hausmann, 227 Lowell Ave., Charlestown, Ind.

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, 2nd Wed. PRES., S. C. Gale, 1628 W. 4th Ave. SECY., D. A. English, 1606 W. 1st Ave. (9).

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, 4th Wed. PRES., F. D. Putnam, 115 Pulsifer Dr., Auburn. SECY., Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, 3rd Mon. PRES., J. A. Guy, 478 W. Fifth Ave. (1). SECY., W. A. Schoonover, 2901 N. High St. (2).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets 1st Tues. PRES., F. W. Wilson, 222-24 E. 14th St. SECY., R. G. Anderson, 1758 Elmore St. (23).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, 3rd Thurs. PRES., E. J. Hoagland, 257 Whitney St., Hartford. SECY., J. D. Pierce, 775 Capitol Ave., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, 3rd Tues. PRES., C. V. Bankston, 2927 Jackson Ave. (25). SECY., W. B. Martin, Jr., 635 Commercial Place.

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, 2nd Wed. PRES., E. C. Doyle, 315 Washington Ave. SECY., H. F. Kruger, 501 7th Ave., Troy.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, 1st Thurs. PRES., Eric Roberts, 417 Market St. SECY., F. K. Crouch, 906 Cerrito St., Albany (6).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, 2nd Mon. PRES., G. V. Zintel, 840 N. Michigan Ave. (11). SECY., H. G. Gragg, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets. 4th Tues. PRES., P. O. Patterson, 6300 N. Oakland Ave. (20). SECY., A. O. Roche, Jr., 3980 Broadway (5).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, 1st Mon. PRES., H. A. Bickel, E. 7 Riverside Ave. SECY., Max Tona, S. 4021 Latawah St.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, 2nd Tues. PRES., W. E. Nanes, 220 Davidson, Bldg. SECY., D. E. Schroeder, 2717 Cambridge.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tues. after 1st Mon. PRES., Charles Yoe, P.O. Box 2239. SECY., T. L. Roberts, 2008 S. Parkwood Lane.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, 1st Mon. PRES., A. S. Hurt, Jr., 2119 Washington St. (8). SECY., S. C. McCann, 210 W. Tenth St. (5).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, 4th Thurs. PRES., G. T. Christie, Midland & Notre Dame. SECY., A. J. McIntyre, 935 Garwood Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston Mass. Meets, 3rd Tues. PRES., G. W. Sprague, 108 Cummington St. SECY., W. G. Burbo, 137 Newbury St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, 3rd Mon. PRES., A. W. Shelby, 972 Union Ave. SECY., A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, 1st Wed. PRES., R. W. Kimmel, 320 Loneworth St. (2). SECY., J. B. Rishel, 656 Selma Rd. (9).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, 1st Mon. after 10th of month. PRES., E. F. Glanz, 1761 W. Forest Ave. (8). SECY., J. H. Spitzley, 1200 Fort St., W. (26).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, 1st Mon. PRES., J. S. Locke, 2753 Fourth Ave., S. (8). SECY., F. G. Vogt, 6530 W. Lake St. (16).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. Meets, 4th Mon. PRES., J. E. Davis, Jr., P.O. Box 3216, West Jackson (7). SECY., L. H. Smith, 711 W. Capitol St.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, 3rd Mon. PRES., R. J. Ker, 5000 Namur St. (9). SECY., W. E. Jarvis, P.O. Box 61.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, 2nd Tues. PRES., C. A. Goth, Omaha National Bank Bldg. (2). SECY., L. J. Paulsen, 1901 S. 39th St.

● **NEW MEXICO:** 1954. Hdqrs., Albuquerque, N. M. Meets, 3rd Mon. PRES., H. F. Munn, 419 Granite, N.W. SECY., J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, 3rd Mon. PRES., Albert Giannini, 385 Madison Ave. (17). SECY., Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, 2nd Tues. PRES., C. H. Smith, 2300 N. Stiles St., Linden. SECY., M. C. Christesen, 196 Everett Pl., Englewood.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, 3rd Mon. PRES., J. A. Ray, 4411 Belmont Ave. (4). SECY., G. H. Meffert, 3328 Greenbrier Dr. (5).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, 2nd Tues. PRES., J. T. McKinney, P.O. Box 5145 (16). SECY., G. A. McCune, 1908 Utica Square.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, 2nd Mon. PRES., D. E. Mannen, 9104 Woodland Ave. (3). SECY., H. R. Canoyer, 1900 Superior Ave. (14).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N. C. Meets, 2nd or 3rd Fri. PRES., S. T. Oliver, 2307 Fairfield Ave. SECY., E. D. Frazier, 320 Ashland Dr.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, 2nd Mon. PRES., G. E. Ervin, 2800 N. Oklahoma St. (5). SECY., F. R. Denham, 320 Oklahoma Natural Bldg.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, 1st Mon. PRES., M. C. Bailey, 1139 Bay St. SECY., H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thurs. after 1st Tues. PRES., Dick Blankenship, Cascade Bldg. (4). SECY., W. B. Hayes, 6446 NE 24th (11).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, 3rd Tues. PRES., W. J. Robinson, 200½ Bank St. SECY., N. J. Howes, Box 264, R.R. 1.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, 2nd Tues. PRES., T. C. Caskey, 11642—26th Ave., S. (88). SECY., E. W. Triol, 407 Medical Arts Bldg. (1).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, 2nd Thurs. PRES., A. M. Robertson, 1200 Locust St. (7). SECY., R. J. Sigel, 6 Hampden Ave., Narberth.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, 3rd Mon., PRES., E. C. Hach, 221 Broadmoor Ave. (34). SECY., E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, 1st Wed. PRES., L. L. DeLong, 2027 S. Washington St. (10). SECY., W. V. Burbank, P.O. Box 840.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, 1st Wed. PRES., R. A. Sarro, 5412 Argo Way (21). SECY., M. J. Delavan, 405 Meister Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, 2nd Tues. PRES., G. H. Bemarkt, St. Clair Dr., R.R. 1, Caseyville, Ill. SECY., W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, 3rd Thurs. PRES., J. S. Malahy, Jr., 1839 Line Ave. SECY., H. E. Scott, 2502 Woodford St.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRES., R. F. Donovan, P.O. Box 3053. SECY., J. E. McMurray, 1639 Blanding St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, 3rd Fri. PRES., J. W. Holland, 245 Esperson Bldg. (2). SECY., J. C. Lewis, Box 8188.

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, 1st Tues. PRES., C. D. Walz, 3600 San Pasqual St., Pasadena (10). SECY., H. F. Ulovec, 3886 Olympiad Dr. (43).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRES., L. F. Lawrence, Jr., 212 Greystone Rd. SECY., G. C. Garrett, P.O. Box 3697.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, 3rd Tues. PRES., L. H. Hornor, Jr., 816 Insurance Bldg. SECY., Boone Crisp, P.O. Box 9065 (4).

● **TOLEDO:** 1954. Hdqrs., Toledo, Ohio. PRES., F. C. Richardson, Jr., 1938 Shenandoah Rd. (7) SECY., J. F. Guest, 1815 N. 13th St. (2).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, 3rd Thurs. PRES., A. A. Maycock, P.O. Box 36 (10). SECY., W. L. Stuewe, 1472 S. State St. (4).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, 3rd Wed. PRES., T. B. Carpenter, 8400 Millard St. SECY., C. G. Conaway, Jr., 4701 Colley Ave. (5).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, 2nd Wed. PRES., W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY., S. H. Robbins, Jr., 2009 K St., N.W.

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. Meets, 1st Tues. PRES., R. S. Carow, P.O. Box 3206. SECY., H. L. Mayes, P.O. Box 151.

● **WESTERN MASSACHUSETTS:** 1955. Hdqrs., Springfield. PRES., R. E. Cross, 114 Boston Rd. SECY., F. A. Ferraro, 172 Chestnut St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, 2nd Mon. PRES., F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECY., F. L. Murray, 482 W. Michigan Ave., Battle Creek.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, 2nd Mon. PRES., O. P. Thompson, 260 Richmond Ave. (22). SECY., G. E. Kuhn, 475 Woodland Dr., Kenmore (23).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, 3rd Mon. PRES., L. C. Plaehn, 914 N. Broadway (2). SECY., H. W. Alyea, 507 E. Michigan St. (2).

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● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRES., H. C. Bechtler, Anemonenstrasse 40 (47). SECY., Walter Hausler, Erbstrasse 2, Kusnacht.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRES., Alvah Ehrman, Box 4502, State College Station. SECY., R. W. McDonald, 1010½ Vance St.

● **OKLAHOMA A. & M. COLLEGE:** 1950 Hdqrs., Stillwater, Okla. PRES., C. E. Durrett, 1215 College. SECY., R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, 1st Wed. after 1st Tues. PRES., R. E. Bulletset, 252 Kings Rd. SECY., I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. PRES., D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY., J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, 2nd and 4th Tues. PRES., D. F. Carroll, Box 6264. SECY., C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, 1st Tues. PRES., J. C. Rumpf, 16511 Muirland (21). SECY., L. J. Hayes, Jr., University of Detroit.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, 1st and 3rd Tues.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont., Canada. PRES., W. A. Stewart, 86 Roxborough St., W. (5). SECY., R. M. Davies, 144 Manor Rd., E.

Simplicity and Good Design Features in

POWERS

FLOWRITE VALVES

STURDY, PRACTICAL DESIGN
Strong, light weight precision cast alloy housing is corrosion resistant. Only 6 bolts saves maintenance time.

OVER 60 YEARS
of Temperature and Humidity Control.

Ball Check Lubricator with Silicone grease for temperatures 40° to 500° F.

(b98)

give close control and they last longer

1. **Diaphragm** has a formed bead which provides increased sealing action with increasing control pressure. It has no bolt holes. Diaphragm lasts longer.

2. **Piston plate assembly** has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains valve stem in accurate alignment. High tensile strength steel spring is cadmium plated and completely enclosed.

3. **Adjustment screw** is non-rising ball bearing type cadmium plated, easily accessible, easy to adjust.

4. **Packing:** Deep packing space contains preformed lubricated packing readily accessible. Note lubricator.

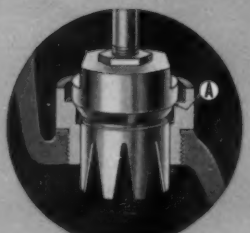
Accurate control results from smooth rolling diaphragm and minimum of valve stem friction.

Right type and size of valve is important for good control. An experienced Powers engineer will gladly help you make the right selection. Call our nearest office or write us direct.

For Pressures up to 250 PSI.

AT NO EXTRA COST
POWERS CONTROL SYSTEMS
Include these Premium Quality Valves

Get complete information, write for series 344 bulletins



Renewable Stainless Steel, Disc and Seat.

Compare POWERS Single Seat Valves with other high quality valves. Check their performance, tight shut off feature and sturdy construction.

Available: Composition Disc also V-Port characterized which gives straight line control. Separate shut off seat (A) reduces wire drawing, insures tight shut off.

SINGLE SEAT • DOUBLE SEAT • 3-WAY MIXING VALVES

Established 1891 **THE POWERS REGULATOR COMPANY** Skokie, Illinois

Offices in Chief Cities in U.S.A., Canada and Mexico, See Your Phone Book

STEEL PIPE

AT AMERICA'S CROSSROADS

Steel pipe, like any other commodity, is good only if you can get it. *When* you want it, *where* you want it. In *sizes* that you need, in *grades* that suit your purposes.

AVAILABILITY: One word sums it up.

And steel pipe *is* available . . . thanks to the thousands of *jobbers* and *distributors* throughout the land. At the crossroads of America . . . serving the distribution function between mill and user with an effectiveness that could not be economically achieved by any other method.

The manufacturers of steel pipe acknowledge the great contribution of their jobber and distributor outlets with pride. Here is American business at its best . . . coordinating production and distribution for the good of all!

Steel Pipe is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N.Y.

The true cost of an expansion joint is not the figure on the manufacturer's price tag. Many factors enter into any such cost determination. For example, an expansion joint that fails just when it shouldn't could wreck a plant and cost a small fortune. And, assuming equal first-cost of any two competitive manufacturers' designs, one that stands up twice as long as the other . . . costs only half as much on a unit-time basis. So, one really shouldn't count on "price" as a measure of value.

But here is one thing you can count on. Every single expansion joint in the Zallea line is designed and built to assure maximum reliability —and top value for your dollar. This is no empty boast, but a fact that can be confirmed for you by figures.

So, whenever you have problems—or needs—relating to expansion joints, don't fail to get in touch with Zallea. Write today for Bulletin 351, containing condensed descriptions of the many types. There is a Zallea joint for every requirement.

Zallea expansion joints

ZALLEA BROTHERS, 816 LOCUST STREET, WILMINGTON 99, DELAWARE

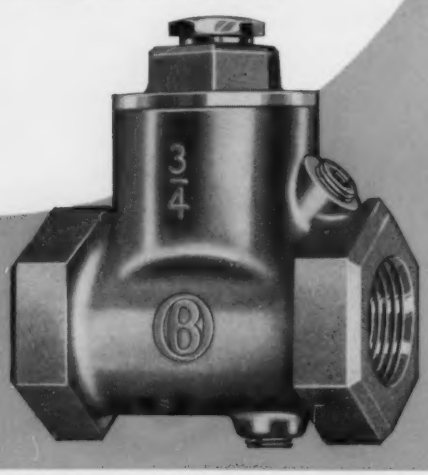
World's Largest Manufacturers of Expansion Joints

Use this O-B Valve Combination

. . . for complete balancing . . . for individual temperature control in Central Air Conditioning and Heating

Here's the modern way to use valves to regulate operation of a central air conditioning or heating system.

For balancing use O-B Equatemp®, available with either threaded or solder-type pipe ends. It balances *and* shuts off and can be used for purging. Thus it does a job that formerly required two or more valves or fittings.



For separate control of individual units, use the No. 4600, O-B's new low-cost three-way valve. Its parallel, double-seat construction enables occupants of each room to regulate temperature to fit their individual comfort, without affecting other units in the system.

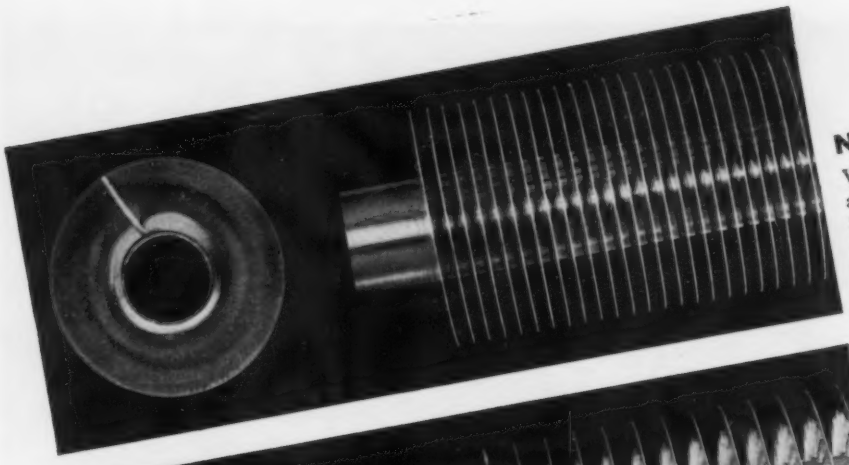
Regardless of the position of the three-way valve, the quantity of water pumped through the system does not change. This means pump delivery remains constant. Danger of overloading pump motors is virtually eliminated.

The 4600 is available with either threaded, or solder-type pipe ends. Use it with the O-B Equatemp to get an easily balanced, closely controlled system at a low price.

Ohio Brass

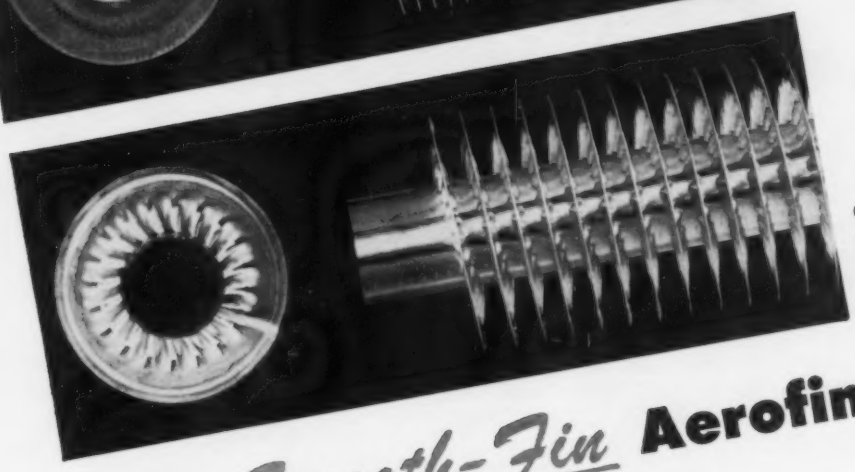
MANSFIELD OHIO, U.S.A.

4572-V



New Smooth Fins

Wide base provides ample contact surface. Smooth fins can be closely spaced without increasing resistance.



Old Type Fins

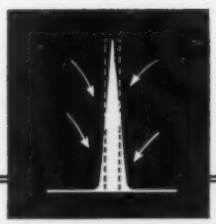
Crimped to provide necessary contact surface, widely spaced to reduce air friction.

NEW *Smooth-Fin* Aerofin Coils for Greater Capacity— Lower Resistance

Aerofin extended-surface heating and cooling coils now offer you an even greater area of effective surface — even greater capacity — per square foot of face area. Airway resistance is lowered; higher air velocities can be used. The result is extremely high heating or cooling capacity in a given space.

Compact, sturdy, standardized encased units arranged for simple, quick, economical installation.

Write for Bulletin S-55



The new Aerofin smooth fins are tapered, with wide base that conducts sufficient heat between fin and tube to make the entire fin effective transfer surface.

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

Electronic Air Cleaning vs. Air Filtering?

Fact:

Test Proves Westinghouse PRECIPITRON®

Removes Over 5 Times More Airborne Dirt

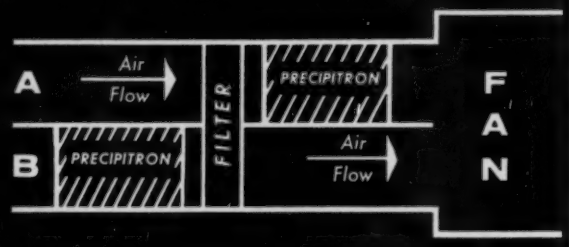


FIGURE 1

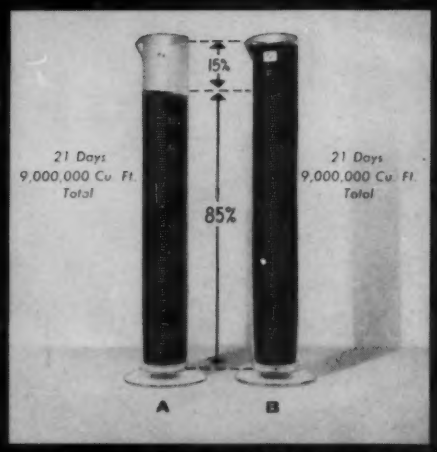


FIGURE 2

Dirt scraped from PRECIPITRON cells

How much better is PRECIPITRON Electronic Air Cleaning for removing dirt particles from air for ventilating and air conditioning? The answer is shown by this dramatic research test, comparing the performance of a conventional mechanical air filter with PRECIPITRON.

In the test, equal quantities of outdoor air were drawn through two identical channels as shown in Figure 1. In Channel A, air was first filtered and then PRECIPITRON-cleaned. A duplicate filter was placed in Channel B after the PRECIPITRON to balance the air flow.

After 21 days of operation, a total of 9,000,000 cubic feet of air had passed through each channel. The accumulated dirt was recovered from the PRECIPITRON collector cells in each channel, and carefully weighed.

In Figure 2, Column B indicates the performance of the two air cleaners in Channel B (PRECIPITRON first). The mechanical filter did not collect any measurable amount of dirt.

Column A indicates the performance of the two air cleaners in Channel A (filter first). **Only 15% of the dirt was removed by the mechanical filter.**

85% passed through and was trapped by the PRECIPITRON—over 5 times as much, and that portion contained damaging submicroscopic particles.

MORE FACTS? Call your nearest Westinghouse-Sturtevant Sales Engineer . . . he's the "Man with the Facts" on electronic air cleaning . . . or fill in the coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80442

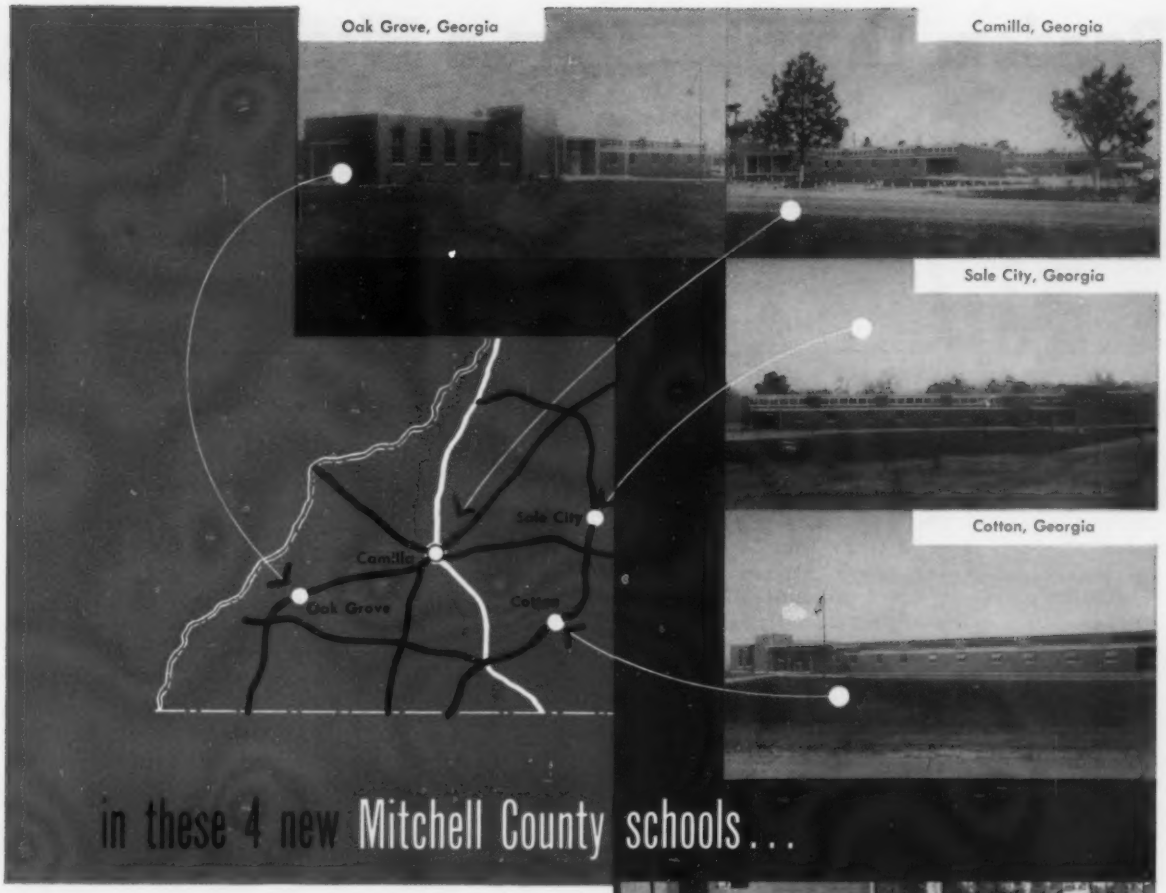
Westinghouse Electric Corporation
Sturtevant Division, Dept. 5-E
Hyde Park, Boston 36, Mass.

Please send more facts on your PRECIPITRON.

NAME AND TITLE .....

COMPANY .....

CITY .....STATE.....



it's SPANG® CW STEEL PIPE for radiant heating

Owner: Mitchell County Board of Education, Camilla, Georgia
Architect: Albany Architects & Engineers, Albany, Georgia
General Contractor: Culpepper & Edwards, Pelham, Georgia
Plumbing Contractors: Lee Brothers Heating & Plumbing Co., Albany, Georgia; Lipsey Heating & Plumbing Co., Albany, Georgia
SPANG Distributor: Engineering & Equipment Co., Albany, Georgia

At four new schools in Mitchell County, Georgia, radiant heating systems built of SPANG CW Steel Pipe were installed to provide constant, uniform heat during the cold, damp winter months. Even temperatures, maintained throughout the buildings by automatic controls, keep students healthier and more comfortable, enabling them to do better classroom work.

SPANG CW Steel Pipe will give these four Mitchell County schools years of dependable service, because SPANG is *quality-controlled* from raw material to finished product. This *quality-control* means that SPANG is easier to cut, bend, thread and weld. All of these are important factors which give you faster, lower-cost installations.

SPANG users know that SPANG CW Steel Pipe is tops for all heating, plumbing, air conditioning, snow melting, and radiant heating installations. Why don't *you* try SPANG? For more information, contact your local SPANG Distributor, or write us direct.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

Random Thoughts from a Filter Engineer

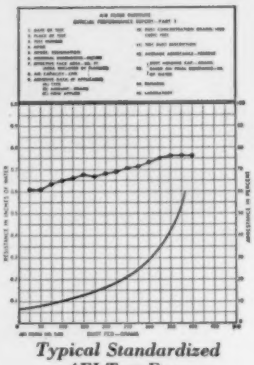
by J. K. Brixius

- **HOW TO COMPARE FILTERS**
- **WE FAVOR THE LIGHT APPROACH**
- **RULE OF THUMB FOR CATCHING DUST**

HOW TO COMPARE FILTERS

If you're like most of us, you always compare one car with another before you buy. But have you ever tried to compare two filters? Most prospective buyers can't evaluate the filters themselves. They have to depend on what each manufacturer says about his filter. That means comparing the results of each manufacturer's filter tests. There's the rub! No two manufacturers run tests under the same conditions. Or with the same test dust. Trying to compare filter test data is like trying to compare apples and oranges. It can't be done.

Manufacturers could easily simplify the customer's problem if they only would. They could do it by running tests with the same test dust, under the same conditions. We at Air-Maze use the standardized test dust and testing equipment developed by the Air Filter Institute. And for electrostatic precipitators, the National Bureau of Standards Discoloration Method, using outside atmospheric dust.



Typical Standardized AFI Test Form

We have just adopted this procedure and hope other companies will join us in these standardized tests. Then comparison *will* be possible.

WE FAVOR THE LIGHT APPROACH

Just the other day we were reading about the millions of dollars aircraft manufacturers spend trying to shave a few pounds off their latest jet. And we thought that airplane manufacturers aren't the only ones fighting against excessive weight. Filter makers are in pretty much the same boat.

We try to make the lightest possible filter that will be strong enough to do its job. A light filter is easier to handle, less likely to be damaged and cheaper to ship. And, we've found from experience, it's usually easier and therefore less costly to handle or service. This adds up to big customer savings, especially in the larger banks of filters.

An example of the Air-Maze light approach: Our P-5 high velocity filter has a stamped 22 gauge cold rolled steel enclosing channel. The channel overlaps at corners which are welded with "shielded-arc" using helium. Both sides of the panel have expanded steel facing tied together to bond the media and channel into a rigid structural unit. Result: As strong as filters with heavier frames, yet weighs less. And the savings are passed on to you!

RULE OF THUMB FOR CATCHING DUST

The problem of what type of filter to use under any given dust condition has puzzled users for many years. Even today, adequate data is lacking to make selection easy. However, we present the chart below as a rough guide, fully realizing that our divisions are arbitrary and may be subject to criticism. We'd be glad to furnish anyone interested with extra copies.

Of course, as most everyone knows, the ability to collect dust down to any given particle size is not the whole story in filter selection. Such very important factors as dirt holding capacity, resistance to air flow, cost, maintenance, and ability to withstand temperature, humidity, and even high altitude conditions, must be considered.

That is why we suggest you let us help you with your air filter selection. Since we make almost every known type, we have no reason except your best interests to consider when making recommendations.

The Air-Maze Corporation, 25000 Miles Road, Cleveland 28, Ohio.

VENTILATION AIR FILTER SPECTRUM

THIS CHART INDICATES THE TYPE OF FILTER GENERALLY USED AND BEST SUITED TO REMOVE VARIOUS ATMOSPHERIC IMPURITY PARTICLE SIZES

PARTICLE SIZE IN MICRONS — 1000 | 20 | 5 | 1/10 | 1/100

TYPE OF FILTER	VISCOUS IMPINGEMENT	DRY AIR FILTER	ELECTRONIC AIR CLEANER (ELECTROSTATIC PRECIPITATOR)	ULTRA FILTER (SUCH AS CWS-6 PAPER OF CHEMICAL CORP AND ATOMIC ENERGY COM.)
RATING TEST	RATED BY WEIGHT OF STANDARD DUST PASSING FILTER WITH AIR FILTER INSTITUTE METHOD	RATED BY WEIGHT OF STANDARD DUST PASSING FILTER WITH AIR FILTER INSTITUTE METHOD	RATED BY DISCOLORATION OF TEST PAPER WITH BUREAU OF STANDARDS TEST METHOD	RATED BY DOP (DIOCTYLPHTHALATE) SMOKE PENETROMETER WITH CHEMICAL CORP METHOD
GENERAL SERVICE	USED TO REMOVE NUISANCE TYPE DUST	USED TO REMOVE SMALLER PARTICLES	USED TO REMOVE LARGE PERCENTAGE OF FINE PARTICLES AND SMOKES	USED FOR HIGHEST EFFICIENCY ON SMALL HEALTH HAZARD PARTICLES
COMMENTS	MOST COMMONLY USED—CHEAPEST PER CFM—EASIEST TO MAINTAIN REDUCES BUT DOES NOT ELIMINATE HOUSECLEANING	COMMONLY USED WHERE VISCOUS IMPINGEMENT DO NOT STOP ENOUGH SMALL PARTICLES ORIGINAL AND MAINTENANCE COST FOR REASONABLE DIRT CAPACITY IS HIGH	COMMONLY USED WHERE HOUSECLEANING MUST BE REDUCED TO A MINIMUM OR HIGH GRADE PROCESS PROTECTION IS REQUIRED GENERALLY USED WITH VISCOUS IMPINGEMENT	OTHER TYPES USED AS PREFILTERS TO REDUCE MAINTENANCE

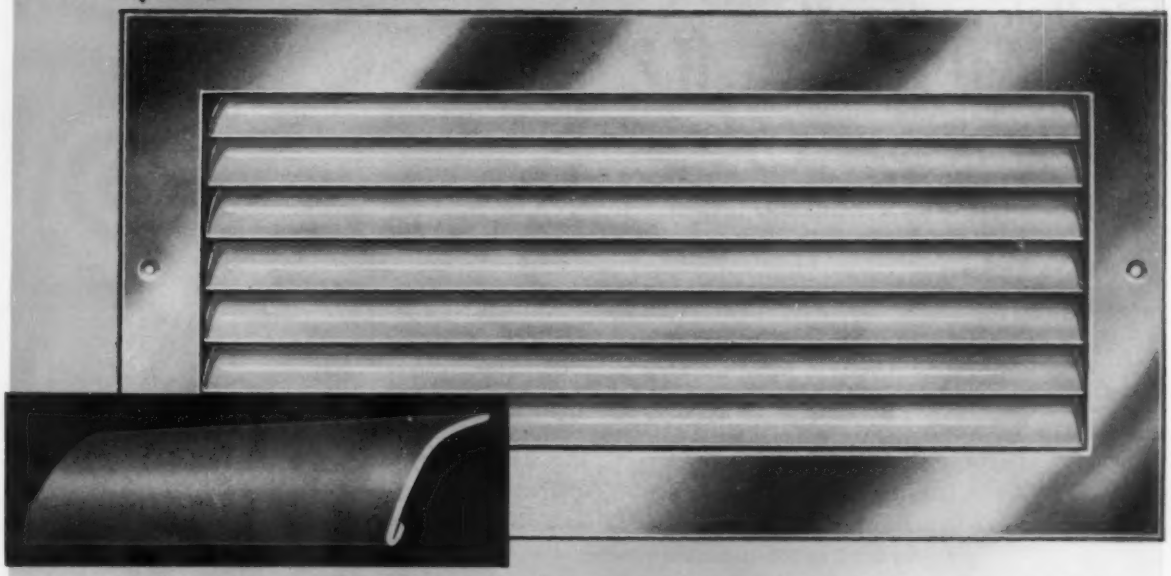
AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

NEW IMPROVED

Return Air Grille



CURVED HEMMED FINS GIVE 80% FREE AREA

designed by

TITUS

Large free area means the Titus Return Air Grilles HANDLE MORE AIR PER SQUARE INCH. Makes it possible for a smaller grille to give superior performance . . . at lowest cost . . . and correct performance faults of other parts of an air conditioning or heating system . . . at the same time.

NEW BEAUTY

Matches design of supply grilles. Curved outline of fins add beauty . . . at the same time make it easy for maintenance personnel to keep grilles clean.

ONE-PIECE ASSEMBLY . . . FOR ANY SIZE OPENING

This eliminates expensive labor of handling old-fashioned grilles that are made in sections. Cuts costs of fitting, butting and screwing together these sections. Brings labor and grille costs to a minimum.

MORE STRENGTH PER SQUARE INCH

The curved hemmed fin design adds rigidity and durability to resist lower wall abuse. There is no see-thru due to the special positioning of the fins.

WRITE FOR FREE CATALOG TODAY

TITUS MANUFACTURING CORP.
WATERLOO, IOWA

Gentlemen: I wish to *improve the heating and air conditioning performance of my forced air systems . . . at the same time lower my grille costs.* Please send me the new illustrated brochure on Titus Return Air Grilles.

Name _____

Company _____

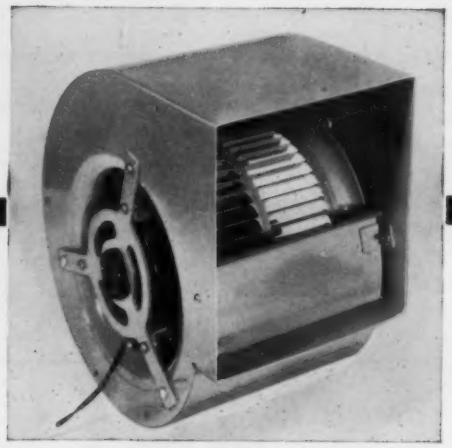
Address _____

City _____ State _____

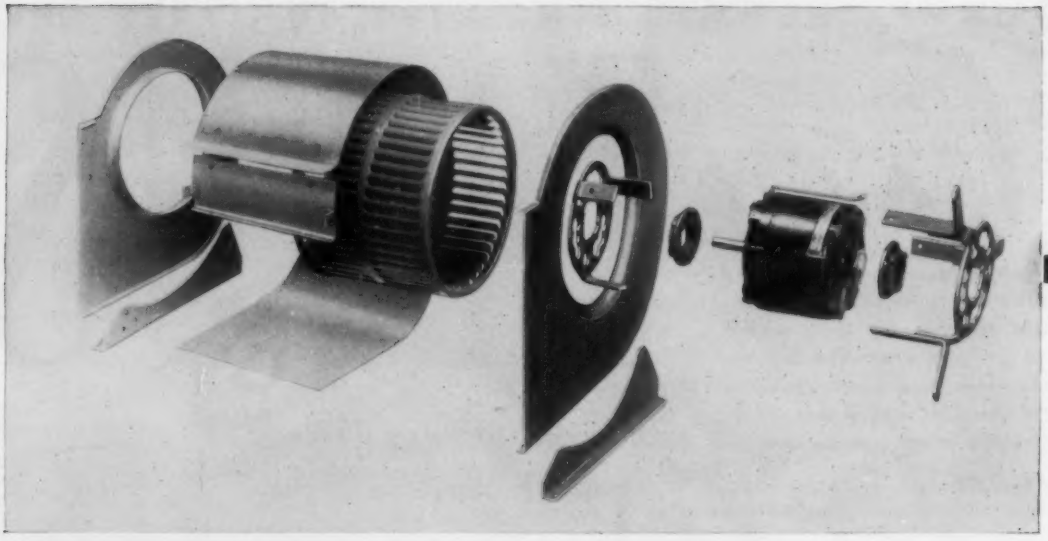
ORIGINAL EQUIPMENT MANUFACTURERS

are finding two ways of reducing cost of their heating and ventilating units by* BUILDING DIRECT DRIVE BLOWERS *into their equipment

1 First — there is a saving of several dollars in cost of the Direct Drive over Belt Driven blower assemblies.



2 Second — There is a saving of 50% of every blower dollar invested by buying MORRISON parts and building their own assemblies.

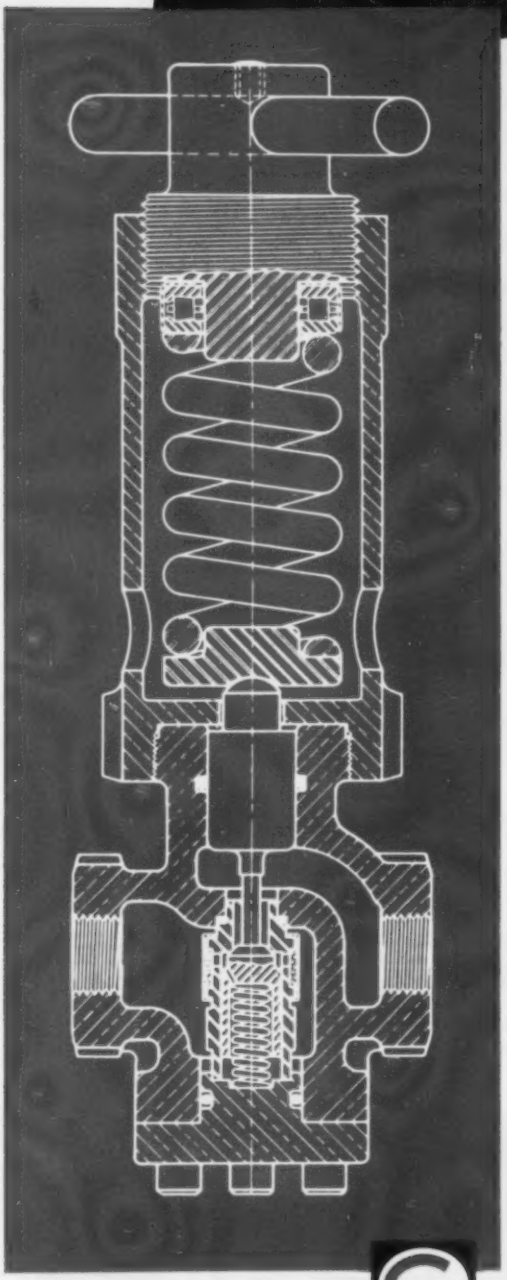


DIRECT DRIVE BLOWERS mean — greater efficiency, less space, less vibration, less noise.

Why not investigate this saving possibility . . . write for literature today.

MORRISON PRODUCTS, INC.
16816 WATERLOO ROAD • CLEVELAND, OHIO

A RUGGED, DEPENDABLE VALVE FOR HIGH-PRESSURE APPLICATIONS



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TYPE 345

Pressure Reducing and Regulating Valve

Designed for hydraulic presses, hydraulic systems, die-mold apparatus and high pressure pneumatic systems (oxygen, nitrogen, hydrogen).

- For use on air, water, oil and various gases (not for steam)
- Inlet pressures: 500 to 4000 psig
- Delivery pressures: 400 to 3000 psig
- Bronze or steel construction
- Piston-operated with O-ring seals
- T-bar adjusting screw combined with roller thrust bearing for ease of adjustment
- Internal strainer screen
- Corrosion resistant
- Operating fluid around renewal unit results in equal expansion and contraction of internal mechanism, precludes sticking or seizing
- Easily serviced without removal from line
- Renewable inner units of nitrided or stainless steel. For severe conditions, stellite facing is available
- Screwed ends, sizes ½", ¾", 1"

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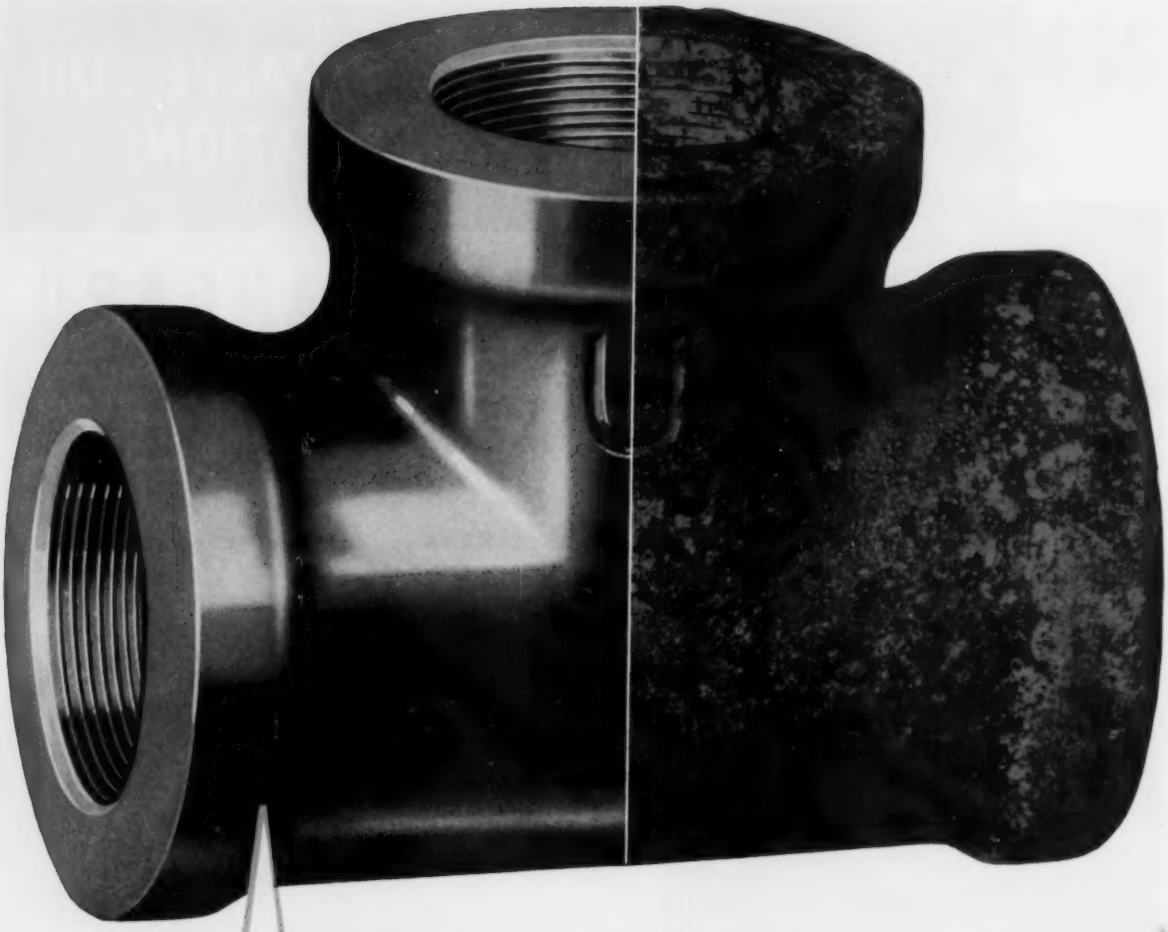
PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS



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RESIST RUST AND CORROSION

AT NO EXTRA COST—you can buy black malleable fittings protected by U-Cote, an exclusive Union Malleable protective coating. U-Coted fittings have been subjected to laboratory tests many times more severe than normal usage — and it's a proven fact that U-Coted fittings will protect you against rust and corrosion loss. For home, business and industrial use, U-Cote deserves first consideration.

A COMPLETE LINE OF FITTINGS DISTRIBUTED THROUGH WHOLESALERS ALL OVER THE WORLD

The UNION MALLEABLE MFG. CO.
ASHLAND, OHIO U. S. A.

Hudson saves $480,000 a year burning coal the modern way

A decision to improve its power service opened many possible courses of action to Hudson Motor Division of American Motors Corp. Based on findings of consultants Boddy, Benjamin and Woodhouse, Inc., Hudson decided to modernize completely its coal-burning, steam, electrical and compressed air equipment.

Today, steam at Hudson is supplied by three new boilers instead of ten old ones. Other new equipment includes a coal-handling system, automatic combustion controls and automatic ash disposal system. Manpower needs in the boiler area have been cut from 14 to 10 and in the compressor area from 8 to 6. With a reliable power supply, Hudson is protected from service interruptions. And the reduced cost of operation resulting from the new equipment will pay off the original investment in six years, leaving an annual saving of $480,000 thereafter!

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Why not talk to a consulting engineer or your nearest coal distributor. Their advice may save you thousands of dollars each year.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can result in a virtually labor-free plant.

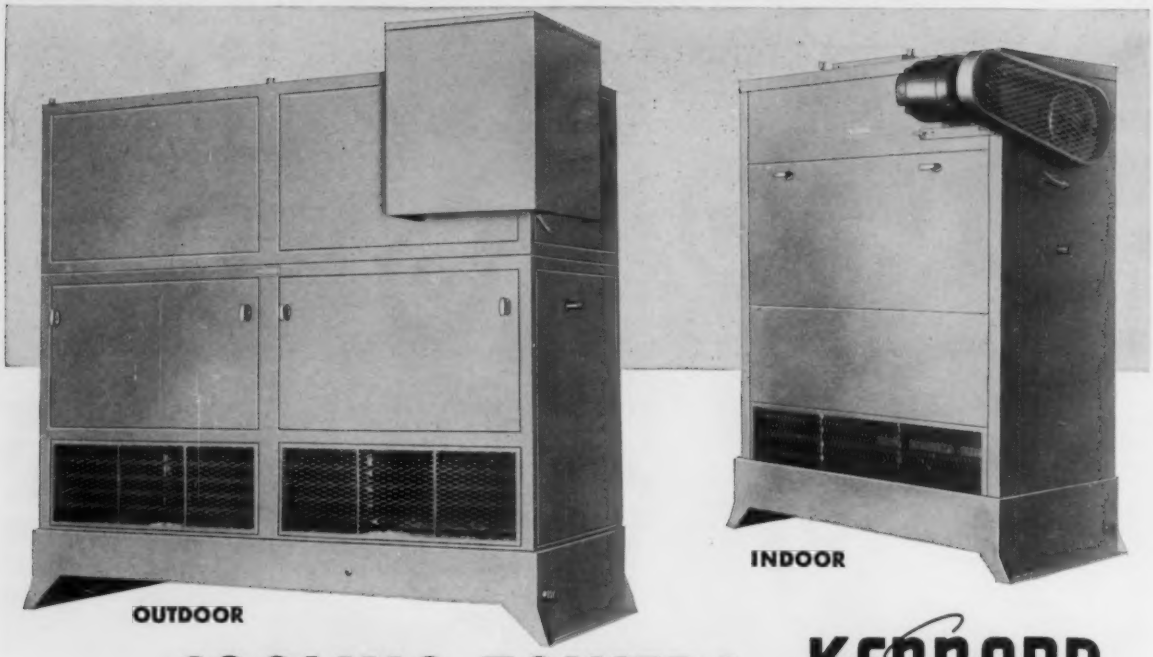
Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

In most industrial areas, bituminous coal is the lowest-cost fuel available.

Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.



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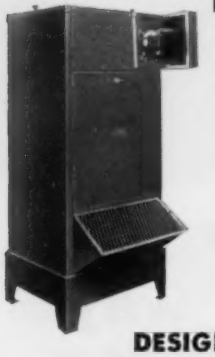
WATER SAVERS . . . . MONEY SAVERS

KENNARD *Engineered*



HOME OR BUSINESS

Kennard KT Cooling Tower—Engineered for long life. Centrifugal fan, vertical air discharge, Redwood wetted deck, Galvanized construction throughout. Brass and Bronze trim. Compact and quiet to place in your home. Efficient and rugged for outdoor commercial use.

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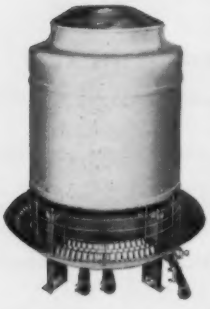
Indoor or Outdoor—sized to meet your requirements. 3, 5, 8, 11 and 16 ton capacities. **Ask for Catalog KT-2.**

DESIGNED FOR THE HOME



The All New Water Saver QT COOLING TOWER

WATER TURBINE DRIVEN fan eliminates electrical connections to the tower and unsightly outdoor wiring and reduces installation costs to a minimum. The FIBERGLASS REINFORCED PLASTIC cabinet and sump pan, combined with clear heart of redwood deck and Stainless Steel grilles, makes it the most corrosion resistant tower available.

Pleasing green color (never requires painting), low in height (42"), vertical air discharge, safe for children and pets. Install outdoors. **Ask for Catalog QT-2.**

KENNARD CORPORATION

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QUALITY LONG-LIVED CONSTRUCTION

Kennard Engineered Cooling Towers are made in 8 sizes—from 15 to 75 tons. Durably built, generously proportioned, designed for maximum service and accessibility. PLUS

- Completely corrosion proofed, hot-dipped Galvanized (after fabrication) wheels and scrolls, sump, blower section and panels. Stainless Steel or Bronze fastenings used throughout.
- Quiet, long-lived operation, efficient fan selections, moderate tip speeds and outlet velocities, oversize bearings and shafts.
- Sectional construction; Door-way-sized sections permits easy building access.
- KENNARD "Penta-Post" construction of frame members allows maximum number of access and service panels.
- Counter flow of the air and water spray and complete intermixing of the two over the generous wetted deck surface.

Consult with our Engineering Department for air conditioning or industrial water saving application—Indoor or Outdoor.

Representatives in All Principal Cities

Why Arizona Public Service chose Triple-Zone Gilsulate to protect 1200-foot fuel and steam lines

Sought lifetime protection against heat loss and corrosion

For its new Saguaro steam electric station near Red Rock, Arizona, the Arizona Public Service Company investigated several types of hot underground pipe insulation. The pipe system consists of three seamless carbon steel hot fuel and steam lines, totalling 1,200 feet, with welded joints running side by side between a 55,000-bbl. fuel oil storage tank and two 950,000 pound/hour steam generators.

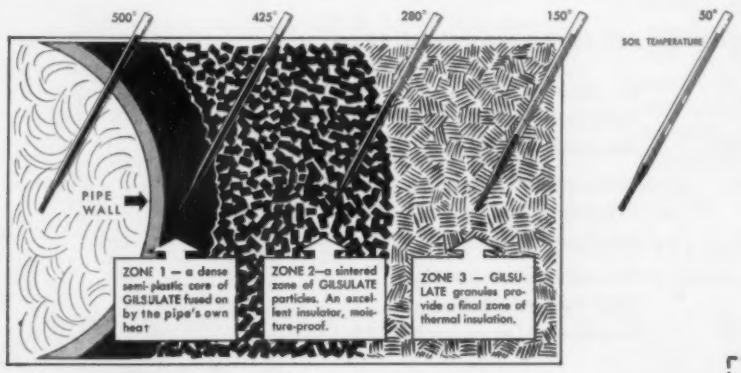
Arizona Public Service Company found that GILSULATE gave the quickest, simplest and most economical system of insulation for its underground hot fuel and steam lines. Approximately 40 tons of GILSULATE were poured and tamped by 10 laborers in two 8-hour shifts – far less time and less expense than required for the other types of insulation investigated.

This is the experience of hundreds of other installations – *Triple-Zone GILSULATE shows the lowest cost per installed linear foot of any hot underground pipe insulation!*

Facts about Gilsulate

1. *Easy to use*—just pour, tamp and backfill...pipe heat does the rest.
2. *Forms 3 zones of protection* against heat loss and all commonly encountered hazards to hot buried pipes.
3. *Needs no sleeves* or mechanical sheaths: no mixing or special handling.
4. *Needs only* normal pipe spacing: for multiple pipe or cramped conditions.
5. *3 types* for varying temperature ranges up to 520° F.

Lines include five horizontal expansion U-bends. A 6-in. fuel oil supply line, a 4-in. fuel oil return, and a 4-in. saturated steam line leading to the fuel oil tank heater were placed side by side in a 37-in. wide trench, and covered with GILSULATE. After light tamping of GILSULATE, trench was backfilled—and the work was done.


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — a dense semi-plastic core of GILSULATE fused on by the pipe's own heat
ZONE 2—a sintered zone of GILSULATE particles. An excellent insulator, moisture-proof.
ZONE 3 — GILSULATE granules provide a final zone of thermal insulation.

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

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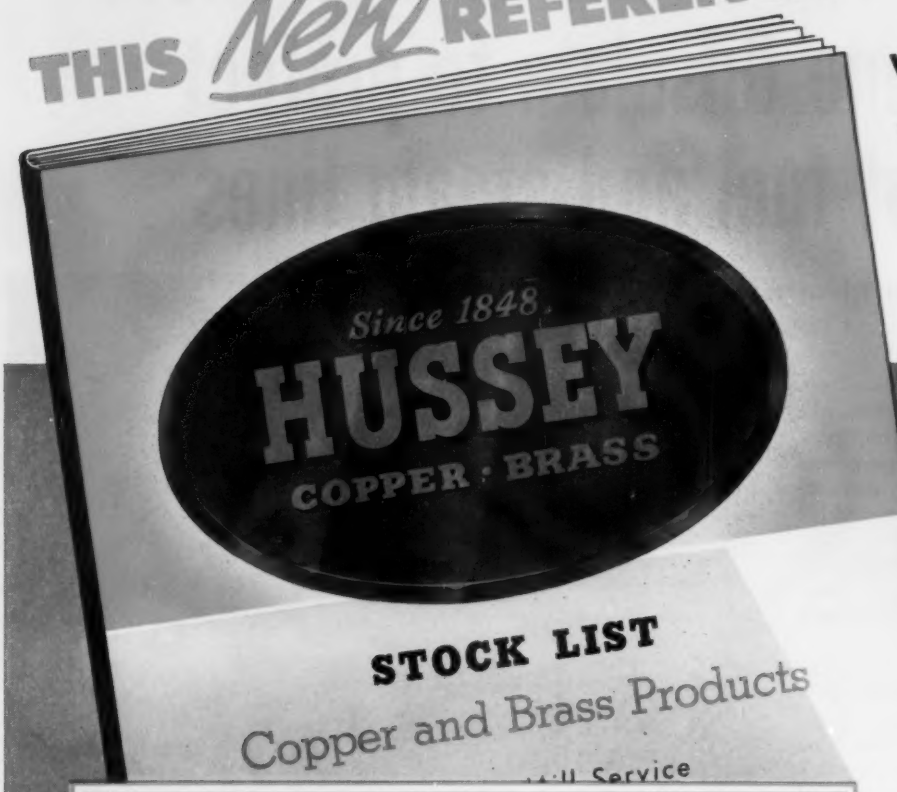

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SCHAUB "03" *Deaerators*

- NEW, SIMPLER PRINCIPLE
- FIGHTS "RETURN LINE" CORROSION
- POSITIVE OXYGEN REMOVAL TO .03 CC/LITER

● Here is a deaerator of Schaub quality, engineered on new principles, designed especially to put effective boiler feed water deaeration within price reach of the small to medium size plant.

These plants, from 3,000 to 30,000 lbs/hr., often running at low pressure, are likely to have the same corrosion and high maintenance costs as their "big brothers". In fact, "Return Line Corrosion" is *most apt* to occur in *low pressure* heating systems even though raw water make up is negligible. For such plants, as well as for high pressure installations, the Schaub .03 Deaerator offers an effective and economical solution that will pay for itself many times over.

The Schaub .03 Deaerator operates *fully vented* at atmospheric pressure. Premium cost construction is eliminated, maintenance and operating costs are reduced to a minimum. Liberated, non-condensible gases escape *immediately* and *completely*. At the same time, simple but effective spray-contact vent condensing, prevents wasteful steam vapor loss. Pin-point temperature control, "live-action" heating and rust-proof chromasoid lining are exclusive features.

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Simple though it is, there's much more to the Schaub .03 Deaerator than can be told here. Bulletin 1300 is filled with information for the operating or consulting engineer responsible for economical and efficient deaeration of boiler feedwater. Tells the "hows" and "whys" of deaeration, especially for the small to medium size plant, explains how the Schaub method differs and its advantages in performance and low cost. Mail the coupon today.

NOTE: The Schaub .03 Deaerator is designed for boilers up to 30,000 lbs. per hour. For capacities up to 100,000 lbs. per hour at .005 cc/liter "zero-oxygen" removal write for Bulletin 575, describing the Schaub Zero-Oxygen Deaerator.

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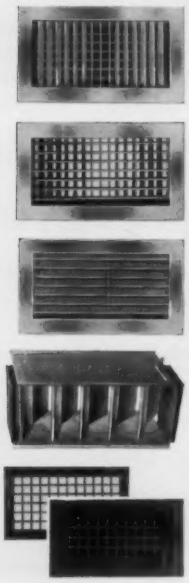

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Ever wonder what General Register needed to leap so swiftly into a position of leadership in this complex business? Money? Yes, plenty—but the right people could raise it. Facilities? Yes, lots of them. Know-how? Talent? Organization? All of these, and tireless effort, too. But all needful things are possible to the right combination of people whose lives and fortunes are pledged to the best management.

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for forming Flexible Duct Connectors

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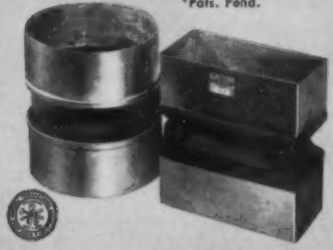

Here's a one-piece, factory-assembled metal-to-material unit that unrolls absolutely *flat!* No waves . . . No buckles! Elgen Silent Duct makes on-the-spot work a cinch! You just measure and cut. You can fabricate *any type* of flexible duct connector in minutes . . . with half the effort! You save up to 60%! No more worry about an inventory of "made-up" parts, either. Choice of U.L. approved, (Gov't. Spec. Mil-D-10860) canvas, Johns-Manville asbestos and U. S. Rubber neoprene coated fibre glass, in 3" or 6" widths attached to 24 or 26 ga. galvanized steel or 24 ga. aluminum to fill every job requirement. In handy 25, 50 and 100 foot rolls.

ELGEN ALL-TITE VANE RUNNERS

for turning vanes for square elbows

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Here's the easiest way ever devised for installing turning vanes for square elbows! Elgen All-Tite Vane Runners eliminate the need for punching, notching, riveting, spot-welding and layout. No special tools are required, either. Just lock the vanes with a single blow of a hammer! 24 gauge galvanized steel; 8 foot lengths.

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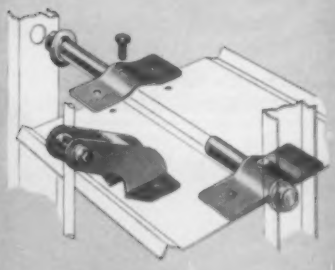

Elgen Damperset for multi-blade dampers, parallel or opposed, is the most perfect damper hardware developed. And it's a wonder for convenience and time-saving! It assembles in a jiffy . . . cuts normal assembly time in half! Easily adjusted and self-aligning. Precision-machined; bronze oil-impregnated bushings; cadmium plated. Licensed by Minneapolis-Honeywell.

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First . . . look at the core. It's seamless, corrugated tin bronze tubing, quality-controlled through every manufacturing stage. This copper-tin alloy is specially engineered to stand up under vibration while carrying gases and liquids under pressure. Because it's *seamless,* there are no joints or laps where leaks can start.

Next . . . for extra strength and durability, it's covered with bronze wire braid securely brazed in place. Sizes through 2" have a single wire braid covering, larger sizes a double braid covering for added strength.

Then . . . before it's shipped, the final assembly is pressure-tested, oven-dried, and sealed in a plastic envelope to keep out dirt and moisture.

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get the features that count . . .

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FASTEST RATE OF HEAT TRANSFER

. . . achieved by blower-induced, constant velocity air flow plus complete water atomization and diffusion over all-prime-surface coils (either copper or hot-dip galvanized steel).

UNSURPASSED STRENGTH AND DURABILITY

. . . they're built of heavy gauge steel and completely hot-dip galvanized after fabrication. Finish can't be scratched, won't rust under severest operating conditions.

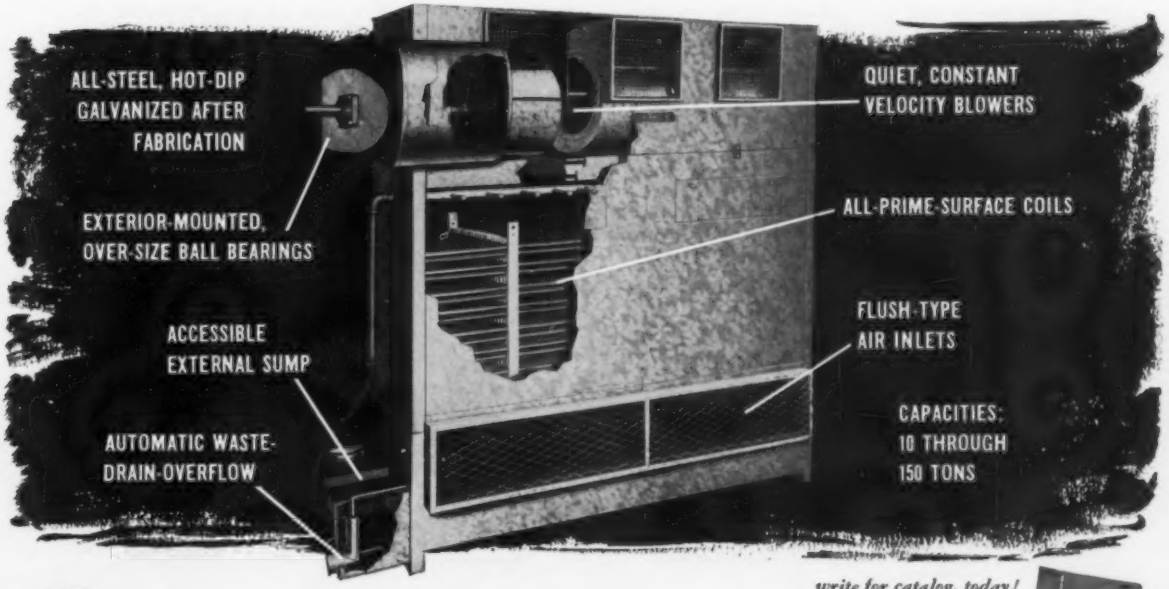
COMPLETELY ACCESSIBLE FOR SERVICING

New external sump box contains water treatment basket, removable sediment screen and automatic waste, drain and overflow, all reached by simply lifting the sump cover.

USE INDOORS OR OUTDOORS — WITH OR WITHOUT DUCTS

Acme's centrifugal blowers (not fans) are quiet and efficient in any indoor or outdoor location — have ample capacity for use with ductwork. You get "performance as rated" — and better!

and you'll like the **COMPACT SIZE** *. . . compare their space-saving dimensions!*



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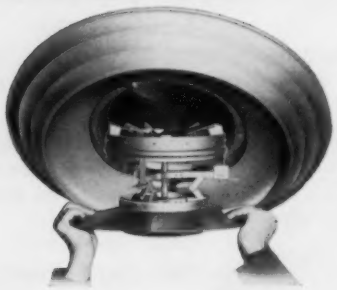
OUTSTANDING FEATURES!

1 Easy Installation

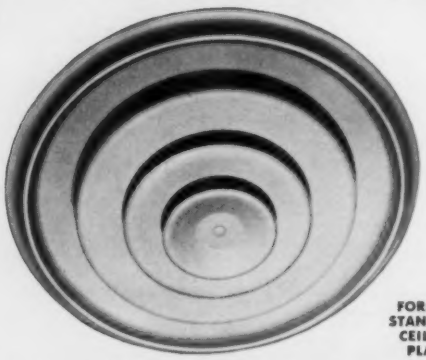


Just 3 simple steps to install Carnes diffusers: (1) Remove center cone and adapter assembly (no tools needed); (2) Fasten ceiling plate to duct work with sheet metal screws; (3) Replace center cone and damper assembly.

2 Fast, Easy Balancing and Adjusting

Both pattern and volume is easily accomplished from the face of the diffuser—without tools. Any pattern from horizontal to vertical is simply obtained.

3 And Lower Prices for Today's Finest!



FORM 1 STANDARD CEILING PLATE

Beautifully styled Model E (fixed cone) and Model EJ (fully adjustable) with standard ceiling plate. Can be mounted on duct work or flush to ceiling. A full range of sizes is available.

FORM 2 DEEP CEILING PLATE

Models E and EJ with deep ceiling plate that prevents ceiling aging and eliminates anti-smudge rings. A complete range of sizes available . . . all fully adjustable for air pattern.

Carnes diffusers appeal to architects for their modern, streamlined appearance; to engineers for their performance and simple balancing; to contractors for their easy installation and low price. You'll be ahead all ways . . . with Carnes!

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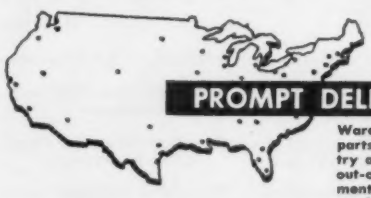


PROMPT DELIVERY

Warehouses in all parts of the country assure prompt, out-of-stock shipment of all Carnes products.

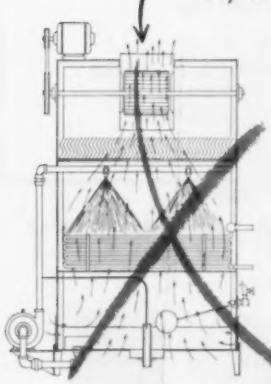
When you buy an evaporative condenser...

Think YEARS AHEAD

If you don't think years ahead you may find yourself burdened with costly problems. For example: corrosion and scaling, deteriorated fans, exorbitant repair bills, days of down-time all caused by moist air continually pulled through the fan section. The way to avoid these future problems is to specify dependable *"Dri-Fan"* by RECOLD. *"Dri-Fan"* is the Evaporative Condenser that pushes *dry air* through the fan section, eliminates corrosion problems, gives you long trouble-free performance. Check the exclusive, patented RECOLD features and see why more and more the order is for *"Dri-Fan."* Available for Freon 12, Freon 22, and ammonia in capacities from 5 to 150 tons, single or multiple circuit installations.

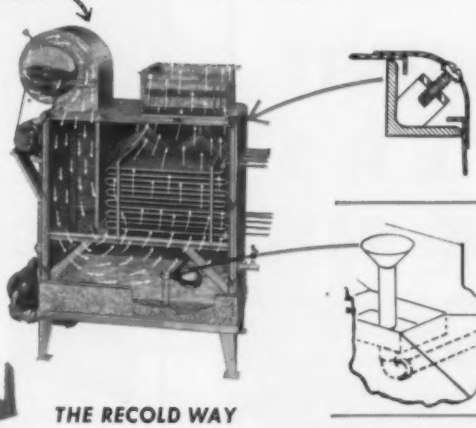
- ***Engineered for quiet operation***
- ***Galvanized construction***
- ***Desuperheat coil available***
- ***Easy to install and service***

"Dri-Fan" Cooling Towers provide the same advantageous construction.



THE OLD WAY

Highly saturated air is constantly pulled through the vulnerable fan section causing corrosion, scaling, deterioration of the fan, shaft and bearings.

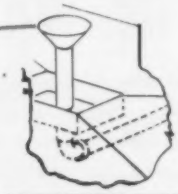


THE RECOLD WAY

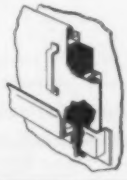
"DRI-FAN" ELIMINATES CORROSION PROBLEMS

RECOLD uses the forced draft principle to push dry air through the condenser. The fan operates in the dry air stream.

Think about serviceability— RECOLD advanced cabinet design provides water-tight panels that are quickly and easily removed.



Think about bleed control— RECOLD "funnel" design assures positive, non-clogging action with scale control and minimum water loss.



Think about accessibility— Patented access door slides easily, provides water-tight seal without use of gaskets or fasteners.

Recold

"DRI-FAN" Trade Mark registered

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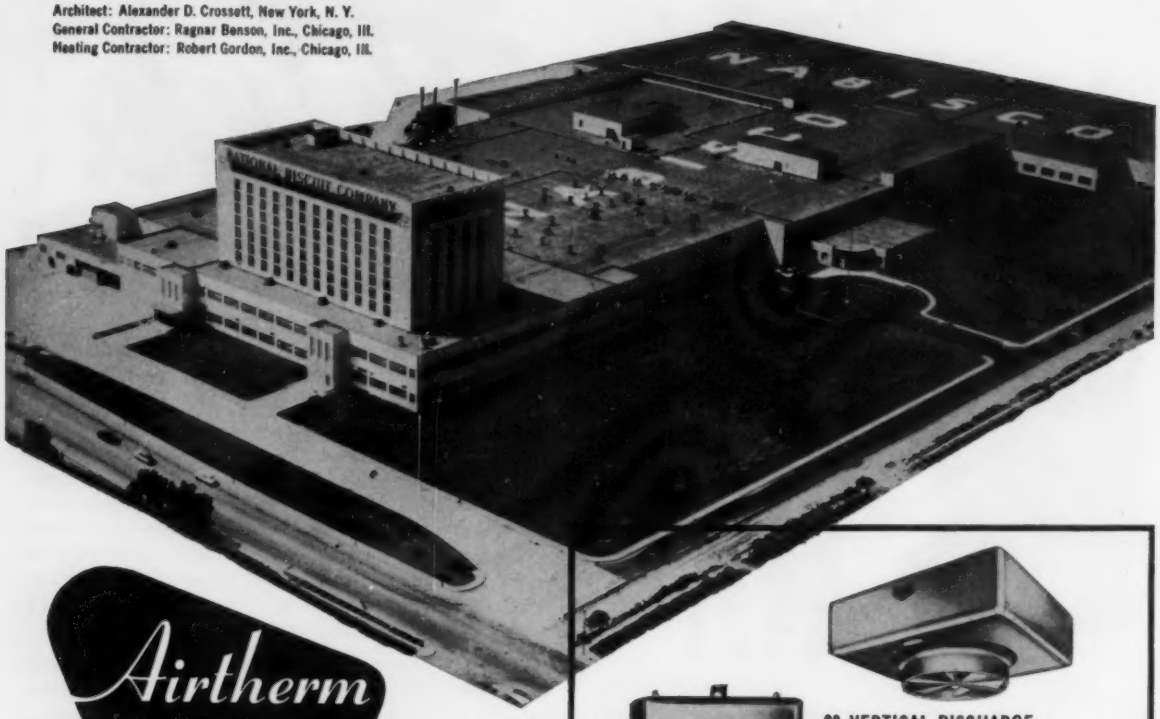
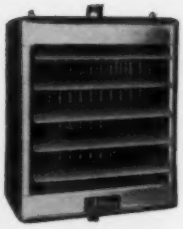
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.



Airtherm



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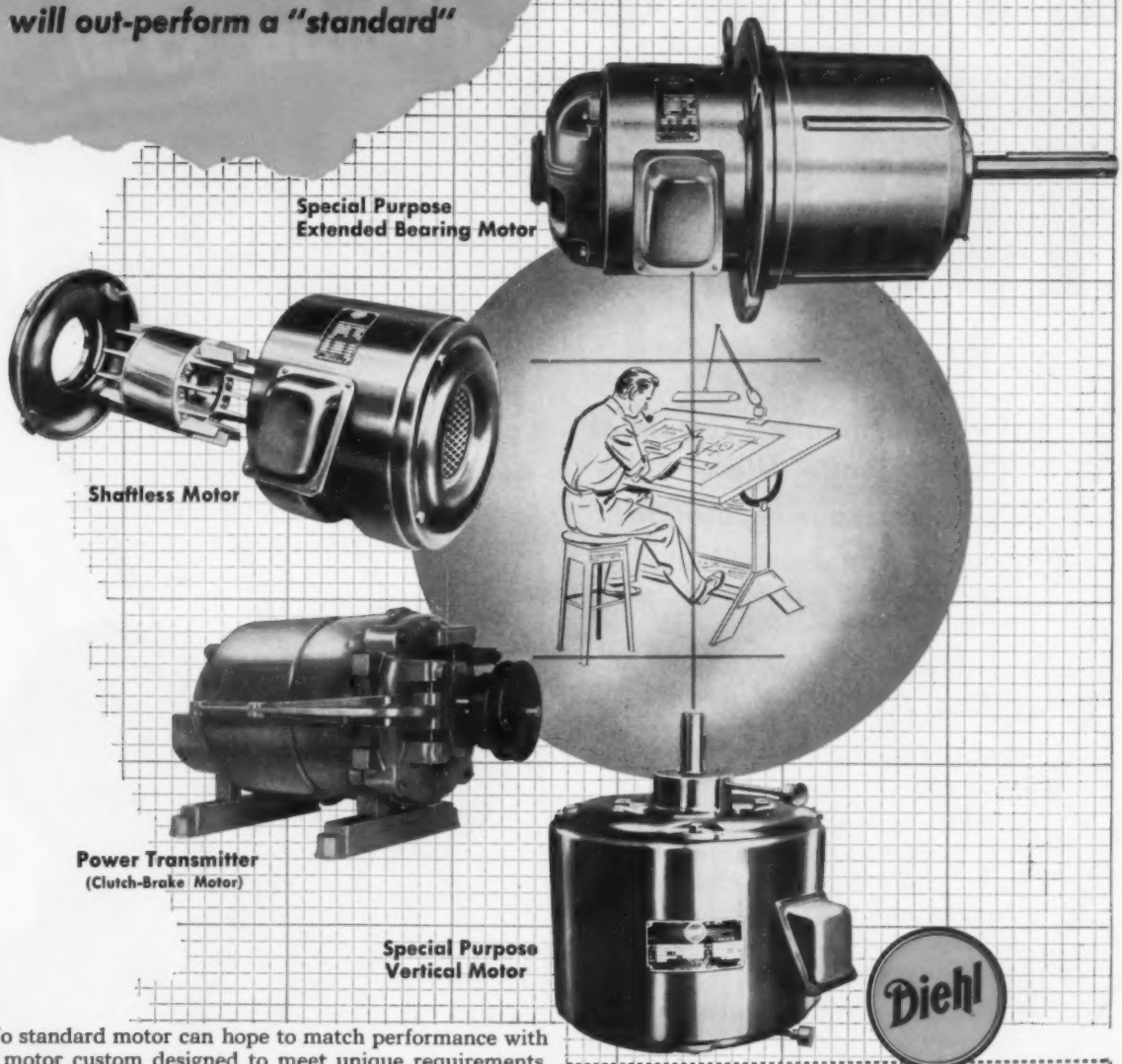
a motor designed for its job

will out-perform a "standard"



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That's why Diehl lays so much emphasis on custom construction . . . why, through the years, it has geared its abilities and its facilities, its design, engineering and manufacturing functions for maximum cooperation with its customers . . . whatever the application.

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Because Chase Copper Water Tube comes in long lengths of 60 to 100 feet, fewer fittings are required – a feature that means easier installation plus a *truly* pressure-tight system!

What's more, the few fittings required are the most leak-proof known – they're solder joints – made with Chase Solder-Joint Fittings. One *more* reason why you can depend on a radiant heating system of *Chase* products!

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1st in Reader Preference . . .

ANOTHER mighty good indication of a publication's effectiveness is its renewal rate.

Here, too, HEATING, PIPING & AIR CONDITIONING is far out front — a vigorous 79.78%* in 1954. What better evidence of superior editorial content!

To reach engineers and contractors, the major purchase-control factors in heating, piping, and air conditioning, you can choose HP&AC with complete confidence. It's the book they PAY to read because it's WORTH it — the only 100% paid (ABC) circulation magazine serving this division of the industrial-large building field. Moreover, the exceptionally high renewal rate proves that the right subscribers are buying in HP&AC a publication that's right for them.

Closing date is the 10th of the preceding month for advertising to this INTERESTED audience. All aboard?

* Average 86.95%, ASHAE members; 67.4%, non-members. Per ABC report Dec. 31, 1954.

KEENEY PUBLISHING 6 N. Michigan, Chicago

ABC AIR CONDITIONING HEADQUARTERS ABP

NEW YORK: 1734 Grand Central Terminal **CLEVELAND:** 737 National City Bank Bldg. **LOS ANGELES:** 672 S. Lafayette Park Place

1st in Circulation

Not only does HP&AC deliver the most circulation, it is the only FULLY paid (ABC) circulation magazine in its field.

1st in Editorial Volume

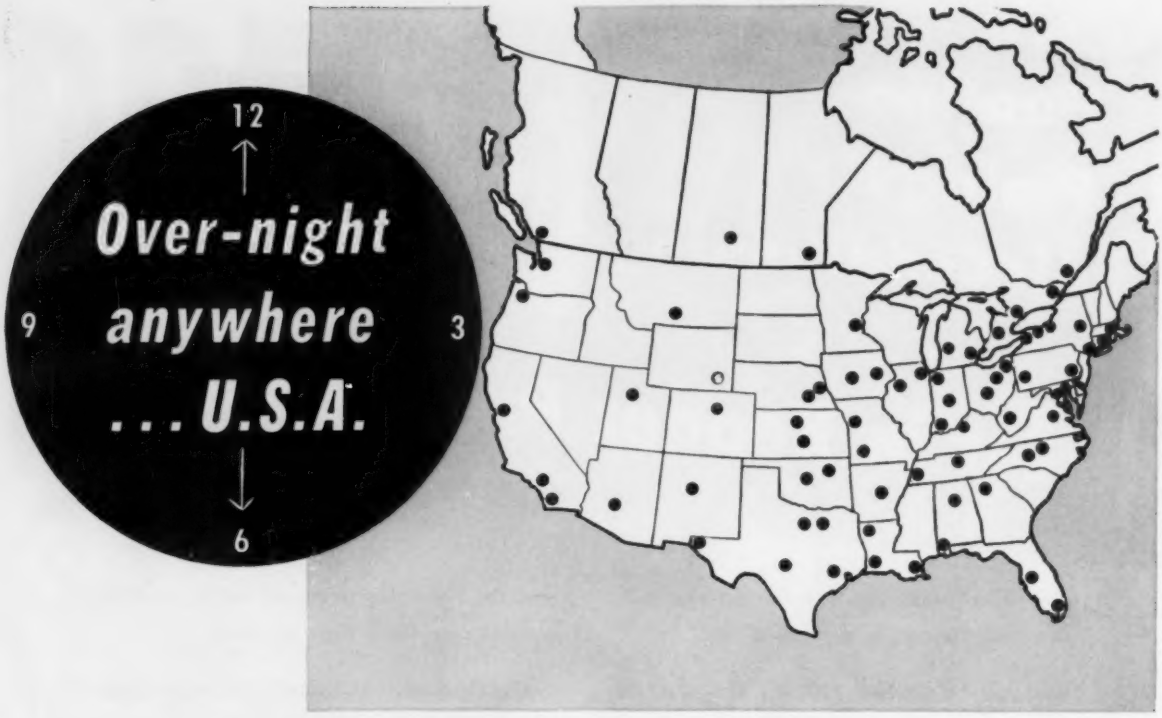
HP&AC has the greatest editorial content. Carries monthly Journal of American Society of Heating and Air-Conditioning Engineers.

1st in Advertisers' Acceptance

More companies advertise in HP&AC. In addition, HP&AC is used exclusively in its field by more advertisers.

1st in Advertising Volume

HP&AC carries more pages of advertising. Significant is the steady growth in this respect, too.



JENN-AIR **LOW-CONTOUR** exhausters

66 Distributors—Coast-to-Coast—Insure Fast Delivery and Service

In these days when speed's the need in building, it's good to know you can depend on fast delivery and service with Jenn-Air Low-Contour Exhausters . . . 66 distributing offices coast-to-coast mean over-night service anywhere in the U. S. A. And since Jenn-Air is the largest manufacturer of wall and roof exhausters in the commercial ventilation field, you can specify with confidence when you select Jenn-Air. So, if you're faced with a close building schedule, select Jenn-Air, and be assured your ventilating installation will be made on time and in time.

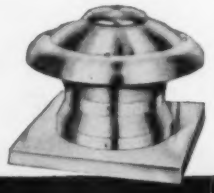
Jenn-Air, First with Low-Contour Exhauster Design

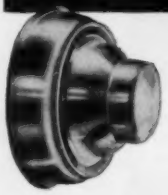
Jenn-Air is the originator of truly "low contour" exhauster design. In considering contour, two levels are important; the discharge level height, which must be sufficient to be above snow or blowing rain, and the over-all level height, which should be low enough to provide true low contour.

Jenn-Air Roof Exhausters with the nesting feature (power assembly nested into base of unit) give a high point of discharge near the top of the unit and still retain the lowest possible contour. In addition Jenn-Air provides a pleasing architectural effect. Write for the name of your closest Jenn-Air distributor.

Jenn-Air — World's Largest Producer of Commercial Wall and Roof Exhausters

Low-contour Roof Exhausters blend with architectural design of building





Wall Exhausters—architecturally sculptured button design spots ventilation control

JENN-AIR PRODUCTS COMPANY, INC.
Architects & Builders Building • Indianapolis 4, Indiana

Dover Stops Rust Cold!

THE COOLING TOWER THAT'S HOT-DIP GALVANIZED AFTER FABRICATION

You put an end to troublesome, costly rust problems when you specify Dover packaged steel cooling towers. Dover, and only Dover, offers you at no extra cost a complete packaged cooling tower that is hot-dip galvanized *after* fabrication. And, another extra: the fan and fan shaft are non-corrosive to prevent rusting and unsightly corrosion ordinarily present after several months of service. These features are standard on all Dover Series "CF" towers.

On Your Next Job, Choose Dover Cooling Towers and Get ALL these Bonus Features

LOWER OPERATING AND MAINTENANCE COSTS . . . with a Dover Tower you get low-cost water cooling for any application requiring from 2 to 100 tons capacity. And the neat, modern design is an integral part of the rugged construction, promising good appearance with low maintenance costs.

NO NOISE PROBLEM . . . there's no noise problem with Dover propeller-type towers. Propeller fans are properly arranged and designed to eliminate noise and to allow for reasonable duct loss for inside installations.

GUARANTEED CAPACITY . . . in a modern fully equipped testing lab at the Dover plant, all tower models have been pre-tested under actual operating conditions. These actual tests make it possible for Dover to *guarantee* delivery of rated thermal capacity.

A stock of Dover packaged steel cooling towers is maintained in four parts of the country, providing fast delivery to all locations. There is a Dover representative near you . . . contact him today or simply fill out the coupon below.

DOVER

INDEPENDENCE, MISSOURI

MANUFACTURING COMPANY

ARIZONA, Phoenix
Karlson Machine Works
ARKANSAS, Little Rock
Mullins Engineering Co.
CALIFORNIA, Los Angeles
Robert R. Derber Co.
San Francisco
The Fulcher Co.
COLORADO, Denver
Burson Sales, Inc.
DISTRICT OF COLUMBIA, Washington
Randall S. Stover
FLORIDA, Jacksonville
H. L. McMurry & Co.
GEORGIA, Atlanta
Hairston & Co.
ILLINOIS, Chicago
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Northwestern Power Equipment Co.
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TEXAS, Dallas
Sam E. Lee & Son
El Paso
Phillips-Moore Equip. Co.
UTAH, Salt Lake City
The Lang Co.
VIRGINIA, Richmond
Power Equipment Co.

MAIL THE ATTACHED COUPON TODAY AND GET FULL INFORMATION!

DOVER MANUFACTURING COMPANY
Department 100, 3117 Weatherford Avenue
Independence, Missouri

☐ Please send me full information about Dover steel cooling towers.

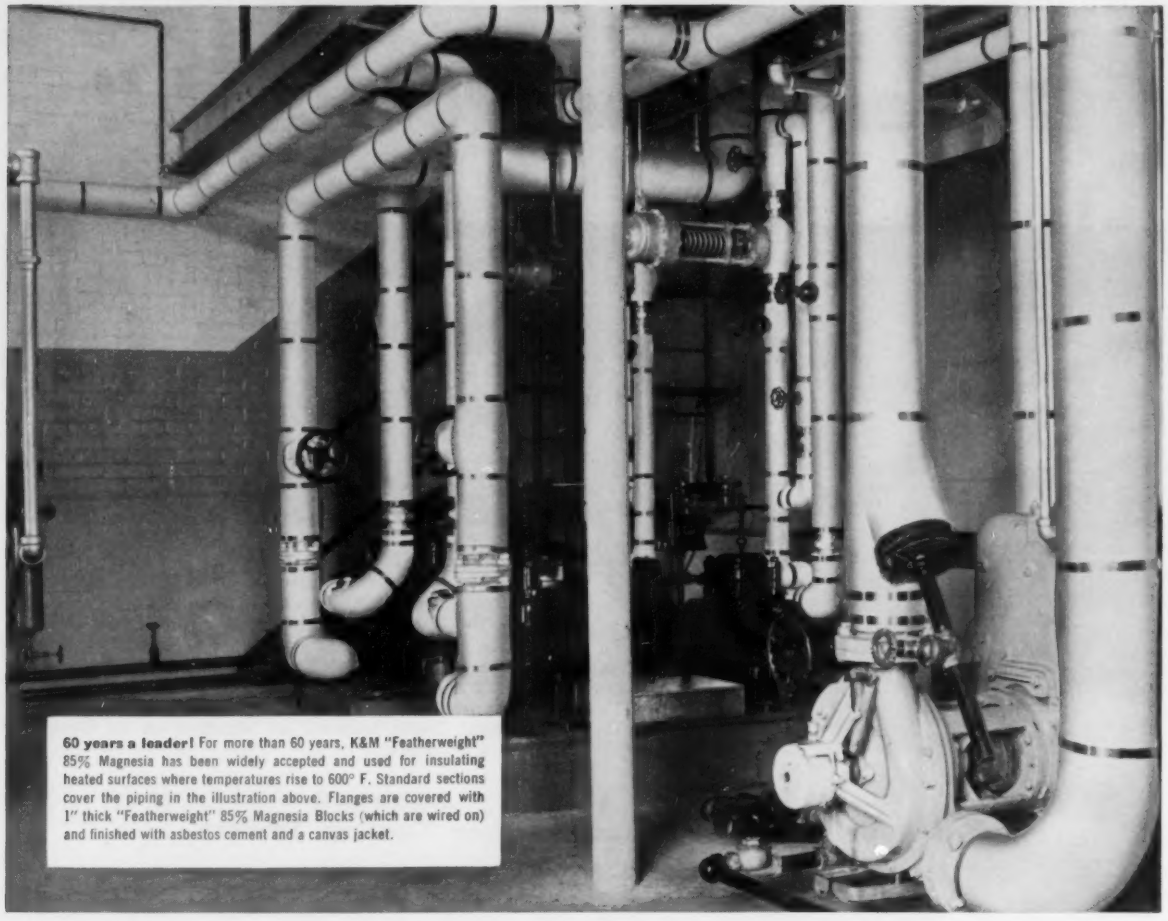
☐ Please have a Dover representative call on me.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____ STATE____



60 years a leader! For more than 60 years, K&M "Featherweight" 85% Magnesia has been widely accepted and used for insulating heated surfaces where temperatures rise to 600° F. Standard sections cover the piping in the illustration above. Flanges are covered with 1" thick "Featherweight" 85% Magnesia Blocks (which are wired on) and finished with asbestos cement and a canvas jacket.

Keep heat where it's wanted with K & M INSULATIONS

Whenever K&M Insulations are used, heat gets where it's wanted—when it's wanted. Within their particular ranges, these high- and low-pressure insulations are all highly efficient. And the complete line meets every heat insulation need. These insulations are always readily available; K&M's modern manufacturing facilities assure plentiful supplies.

K&M "Featherweight" 85% Magnesia Insulation is one of the outstanding products in this line. It's effective on any job where temperatures rise to 600°F. It won't burn; withstands vibration and frequent temperature changes. It's not subject to deterioration, so time will not decrease its efficiency. Use it in either sectional or block form.

Details, distributor's name on request. Your K&M distributor, who is an experienced applicator, has complete information on these insulation products. Write for his name. Data also available directly from us.

K & M LOW-PRESSURE INSULATIONS

K&M Air Cell Pipe, Sheet and Block Insulation
K&M Fine Corrugated Air Cell Pipe, Sheet and Block Insulation
K&M Special Fine Corrugated Air Cell Pipe, Sheet and Block Insulation
K&M Simplex "Super Shrunk" Pipe Insulation
K&M Bestfelt Lamino Sponge Pipe and Block Insulation
K&M Duplex Pipe Insulation
K&M Nu-Wrap Non-Sweat Sectional Pipe Insulation
K&M Amblerex No. 2 Insulating Cement
K&M No. 152 Asbestos Finishing Cement

K & M HIGH-PRESSURE INSULATIONS

K&M "Featherweight" 85% Magnesia Pipe and Block Insulation
K&M Hy-Temp Pipe and Block Insulation
K&M "Featherweight" 85% Magnesia Cement
K&M Hy-Temp Cement
K&M KaytherM Block Insulation

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

Beardsley Terrace Housing, Bridgeport, Conn. • Engineers: Frederick M. Hill and Paul D. Harrigan, New Haven.
Architects: Lindsay & Johnson, Bridgeport. • Heating Contractor: Bridgeport Pipe & Engineering Co., Bridgeport. • General Contractor: E & F Construction Co., Bridgeport.

Huge 1200-family housing development enjoys completely automatic weather-controlled steam heating

THROUGH SARCOTHERM COMPENSATED CONTROL SYSTEMS

CONSISTING of sixteen 8-story buildings, Beardsley Terrace Housing is another huge project where Sarcotherm Steam Heating Control Systems are giving uniform comfort under all weather conditions. As Mechanical Engineer Paul D. Harrigan writes, "Sarcotherm Controls . . . working perfectly through extreme part of Winter as well as in Spring . . . we are enthusiastic about their performance . . . the Housing Authority, the architects and we ourselves are entirely satisfied."

Sixteen Sarcotherm type W Weather-Compensated Control Systems serve Beardsley Terrace. Of the continuous, modulated flow design, they provide individual zone control for the steam heating of each building. Precisely engineered orifice plates assure the proper steam flow to each heating unit.

COMPLETE SARCOTHERM COOPERATION

Whenever *you* are planning a weather-modulated control system, you, too, can take advantage of the unusual service that Sarcotherm offers. This service cooperates in the preparation of working drawings and wiring diagrams for each job. It follows through with on-the-job help and supervision of installation. In fact, this cooperation with the architect, engineer and contractor is so complete that Sarcotherm assumes undivided responsibility for the complete control system, including zone controls, panels, radiator traps and other steam specialties.

Let Sarcotherm work with you on your next project. You'll find it pays. Write for further details. Sarcotherm Controls, Inc., Empire State Building, New York 1, N. Y.

NOTE THESE FEATURES OF SARCOTHERM CONTROLS

1. **Easy to install**
2. **Easy to maintain** — because of simplified construction, fewer parts.
3. **Easy to adjust** — to any desired setting.
4. **Engineered orificing** — assures even heat flow to all units from the start.
5. **Undivided responsibility** — by one maker, Sarcotherm, for the complete control system.

4003-B

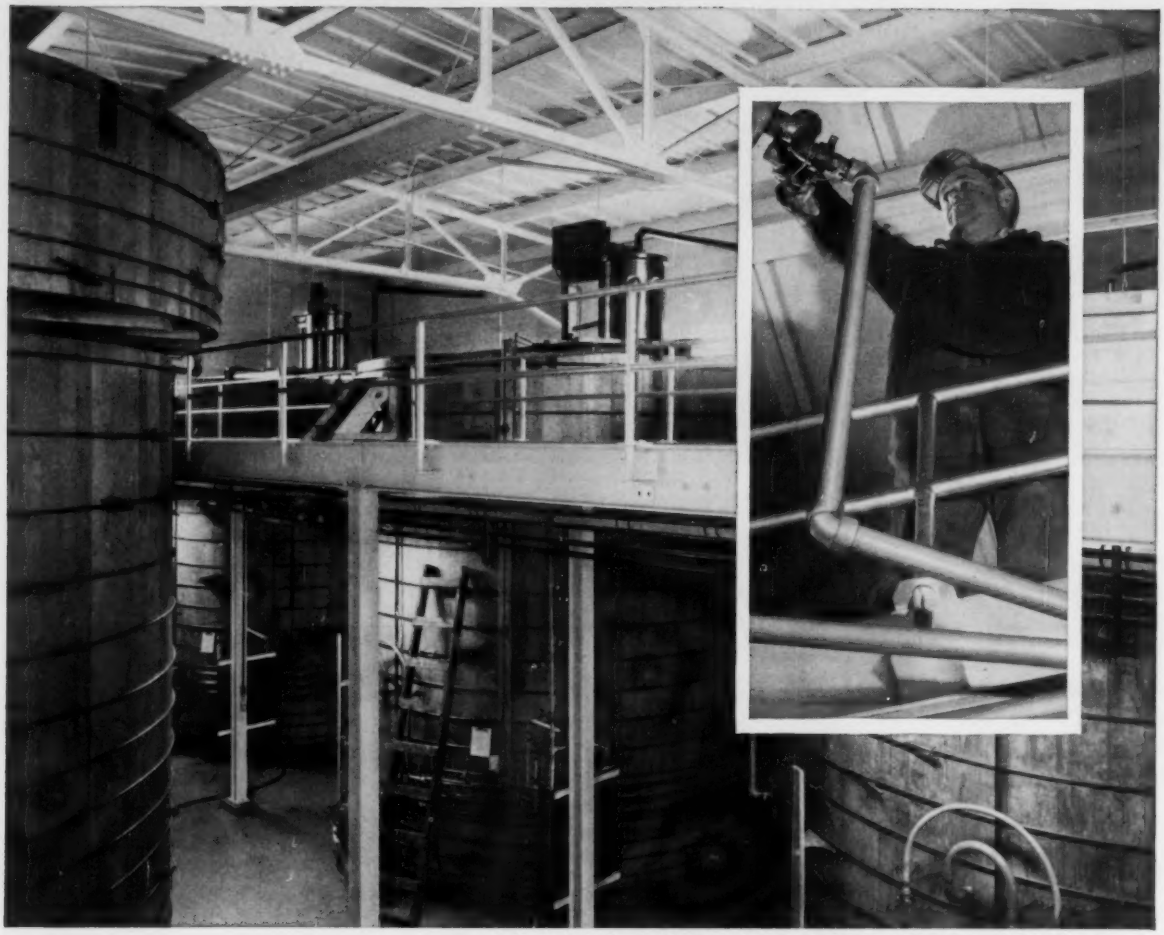
Sarcotherm

An affiliate of SARCO COMPANY, INC.

WEATHER-COMPENSATED CONTROLS FOR **STEAM, HOT WATER AND RADIANT** *HEATING*

Another new development using

B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Company does not manufacture this pipe. We supply only the Geon resin.

Rigid vinyl pipe pays off in vinegar plant

MANUFACTURING and processing 100-grain vinegar—strong enough to eat holes in steel—means high plant piping and maintenance costs in many food plants. But a manufacturer in Ohio recently showed how to take the bite out of the problem, by piping his vinegar plant with high impact plastic pipe made from Geon resin.

The plant's new rigid vinyl pipe is lighter in weight, less costly, easier to install than conventional pipe . . . shows extreme resistance to vinegar and acetic acid corrosion, inside and out, even up to 150°F. It is easier to clean and maintain, does not scale, will not deteriorate with aging.

The remarkable physical properties and chemical inertness of Geon have led to this kind of problem-solving in many industries. Geon polyvinyl materials are adaptable, versatile, easy to compound . . . for molding, coating, extruding, spraying, and calendering.

To help you improve an old product or build superiority into a new one, complete information is available from Dept. BN-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Armaflex . . . *flexible plastic pipe insulation that's fast and easy to apply*

This new, foamed plastic pipe insulation has been developed especially for formed copper tubing and other types of piping that are difficult to insulate. Light in weight, Armstrong Armaflex* is so flexible it can be slipped right on pipes or tubing when they're being installed.

If the lines are already in operation, Armaflex can be slit longitudinally, snapped on the pipe, and sealed with Armstrong No. 520 Adhesive.

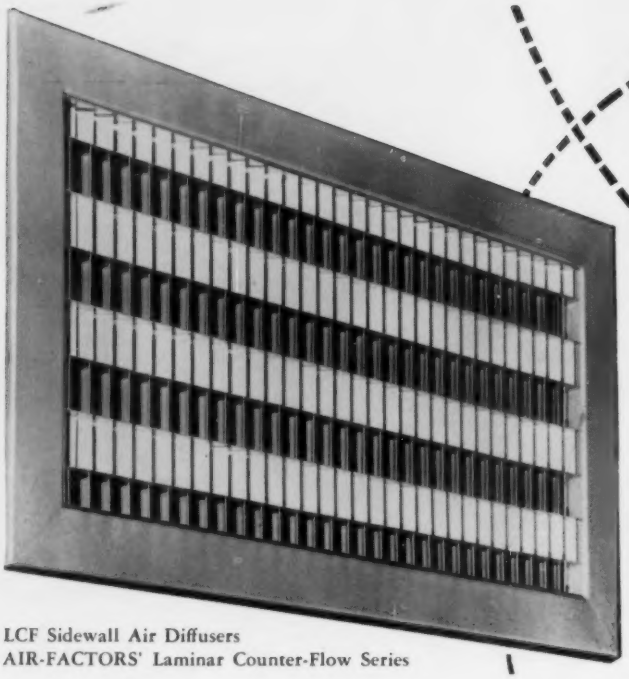
Armstrong Armaflex combines low cost with high efficiency. It will withstand temperatures from 32° F. to 200° F. Its foamed plastic composition is made up of uniformly sized, closed cells that make it air tight and waterproof. No vapor barrier is needed. Armaflex is manufactured with inside diameters of ⅝", ⅞", 1⅛", and 1⅜". Because of its flexibility and resilience, it will fit pipe and tubing with the same or closely corresponding outside diameters.

Armaflex is one of the many new products developed by Armstrong Research to help solve your high- and low-temperature insulation problems. **For free booklets,** with full details on Armaflex as well as the entire line of Armstrong Industrial Insulations and complete Contract Service, call your nearest Armstrong Office or write Armstrong Cork Company, 208 Stratton St., Lancaster, Pa.

*Trade-Mark

Installation is easy. Simply slip Armaflex over straight or bent tubing or pipes. Being flexible, it goes on easily over sweated couplings.

Armstrong INDUSTRIAL INSULATIONS



LCF Sidewall Air Diffusers
AIR-FACTORS' Laminar Counter-Flow Series

A-F AIR-FACTORS INC

PROVIDES A SOLUTION...

where balanced air distribution and air control are essential...

UNUSUAL FACILITIES REQUIRED FOR POLIO AND OTHER COMMUNICABLE DISEASES

The segregation of visitors from patients is a major problem in a communicable diseases hospital. The plan developed by Adrian Wilson-Paul R. Williams, Architects Associated, provides a visitor's balcony surrounding the patient's rooms serviced by separate elevators. Communication is provided with the patient by view windows and telephones, preventing visitors from coming into contact with contaminated areas.

The visitor's balcony arrangement allows around the clock application of polio packs, the operation of "iron lungs" and other treatment without interference or inconvenience from visitors.

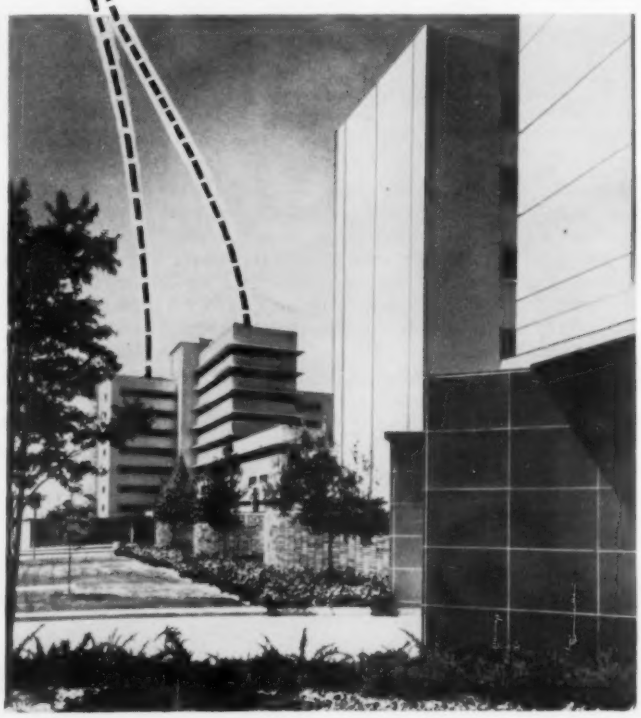
Similar major air conditioning problems were overcome by Hilburg, Hengstler and Turpin, consulting engineers, with their design of a 100 per cent fresh air double duct system that provided heat and refrigeration cooling to individual temperature controlled rooms, and the selection of Air-Factors' Model LCF Sidewall Air Diffusing outlets to provide the very necessary draftless air distribution.

Write for literature

A-F AIR-FACTORS INC
MONROVIA, CALIFORNIA
AIR DISTRIBUTION
AIR CONTROL

• The photograph below shows a section of The Communicable Disease Building, a part of the Los Angeles County General Hospital group... AIR-FACTORS' LCF Sidewall Air Diffusers were specified for the interior of this building.

ADRIAN WILSON-PAUL R. WILLIAMS, ARCHITECTS ASSOCIATED
HILBURG, HENGSTLER AND TURPIN, CONSULTING ENGINEERS
F. B. GARDNER CORP. AIR CONDITIONING CONTRACTOR



Inside—The special zinc coating on Armco ZINCGRIP PAINTGRIP Steel fights rust without any necessity for a protective paint layer.

Outside—The mill-treated surface of this special zinc-coated steel assures an attractive paint finish that won't flake prematurely.

Why This Special Steel Gives Ducts

Extra Protection

Here's why Armco ZINCGRIP PAINTGRIP Steel assures longer maintenance-free service for exposed ductwork in your heating and air conditioning installations:

Its mill-Bonderized surface holds paint much longer than untreated steel. And underneath the paint is a special zinc coating that gives unbroken rust protection.

This double rust protection for your heating and air conditioning ducts means more satisfied customers—longer service without replacement and costly maintenance. You can be sure there will be no premature flaking and peeling of paint.

You'll find this special steel is ideal in high quality casings too.

Let us send you more information about Armco ZINCGRIP PAINTGRIP. You can obtain this special steel from your nearby Armco Distributor.

This scratch test demonstrates ZINCGRIP PAINTGRIP's tight hold on paint. Paint on the untreated half of the panel flakes readily, while the paint on the ZINCGRIP PAINTGRIP half holds fast.

ARMCO STEEL CORPORATION
1375 Curtis Street, Middletown, Ohio
Send me more information on ZINCGRIP PAINTGRIP

NAME_____

COMPANY_____

STREET_____

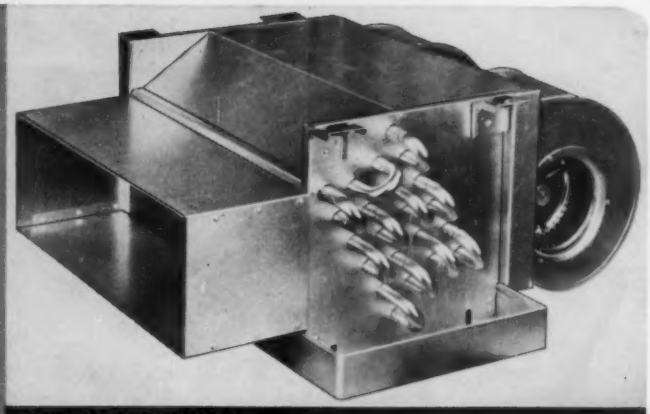
CITY_____ ZONE____ STATE_____

ARMCO STEEL CORPORATION 1375 CURTIS ST., MIDDLETOWN, OHIO

SPECIAL STEELS

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

IT DOESN'T TAKE AN EXPERT TO TELL THE DIFFERENCE!



CEILING HIDEAWAY

128 UNITS

THE TOWN PARK MOTOR HOTEL—MEMPHIS, TENN.

320 UNITS

THE DRAKE HOTEL . . . CHICAGO, ILLINOIS

144 UNITS

THE HOLIDAY INN . . . OKLAHOMA CITY, OKLA.

43 UNITS

THE SKY RIDERS HOTEL . . . PHOENIX, ARIZONA

It's not an exaggeration, but a fact that International Air Conditioning is "the most practical air conditioning ever built". Many businesses, a sample of them shown at the left, testify to the sensible quality of Internationals design and application.

International offers a solution to every air conditioning problem in today's business world. Its extreme quietness, less than the average fan, particularly lends itself to a more pleasant atmosphere . . . All aluminum construction is your best assurance against oxidation and deterioration in the years to come . . . An exclusive double pan arrangment ends your condensation troubles . . . Ducts are attached to the unit and are supplied at no additional cost . . . Internationals motor is wound for 3 speeds and each size unit has a specially designed blower to guarantee the proper amount of air at the lowest noise level possible . . . Maintenance is less with International units due to their practical design. The entire motor and blower assembly can be lifted out and another installed within ten minutes, making servicing and installation easier and less costly.

Quality is not an accident at International.
Its background is sincere intention, honest effort, proper supervision, and skillful rendition

Console Hideaway Units also available in all standard sizes.

PHONE, WRITE OR WIRE FOR COMPLETE ILLUSTRATED LITERATURE AND PRODUCT INFORMATION

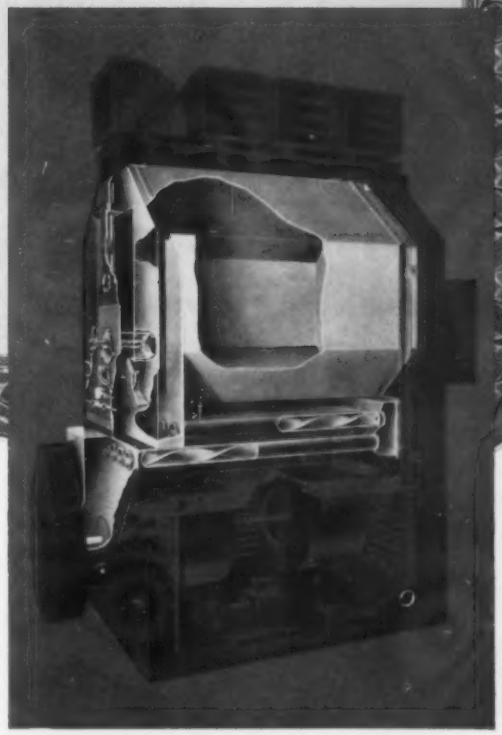
International
MANUFACTURING COMPANY
Air Conditioning Division
600 E. GRAND AVENUE — OKLAHOMA CITY, OKLAHOMA
CABLE ADDRESS "INTIME"

NOW...ANOTHER DRAVO FIRST IN INDUSTRIAL SPACE HEATING

DRAVO COUNTERFLO HEATERS NOW CARRY

A FULLY BONDED 10-YEAR GUARANTEE

ON ALL PARTS WHICH ARE IN DIRECT CONTACT WITH FLAME OR FLUE GASES!



IN THOUSANDS OF INSTALLATIONS, users continuously report the exceptional stamina and long life of Dravo's stainless steel combustion chamber and heat exchange system. This outstanding record enables us to now guarantee long service life of these vital parts for maximum economy in your heating equipment investment. This bonded guarantee is backed not only by Dravo, but also by one of America's foremost bonding and guaranty companies.

ANOTHER EXAMPLE OF DRAVO LEADERSHIP, this bonded guarantee is further evidence of the continuing research and development work that has enabled Dravo to pioneer many industrial space heating equipment improvements. Some of these Dravo-introduced developments are: the floating stainless steel combustion chamber, four-pass combustion system, electronic flame control, U. L. approved design, burners scientifically designed for heater and many other advances to improve heater efficiency and longevity.

IF ECONOMY AND LONGEVITY ARE IMPORTANT TO YOU, why not investigate the heater that consistently leads the field in quality, efficiency, long life and economical operation? You can get complete information on Dravo Heaters by simply checking the coupon at right for the Btu range that covers your requirements—mail it today.

DRAVO
CORPORATION
PITTSBURGH, PENNA.
Sales Representatives in Principal Cities

DRAVO CORPORATION, Department A-1406
Fifth and Liberty Avenues, Pittsburgh 22, Penna.
Please send me complete information about the Dravo:
- ☐ Counterflo Space Heater (400,000-2,000,000 Btu/hr. output)
- ☐ Paraflo Space Heater (200,000-250,000 Btu/hr. output)
- ☐ Gas Fired Unit Heater (68,000-180,000 Btu/hr. output)
- ☐ Please have a representative call at no obligation to me.

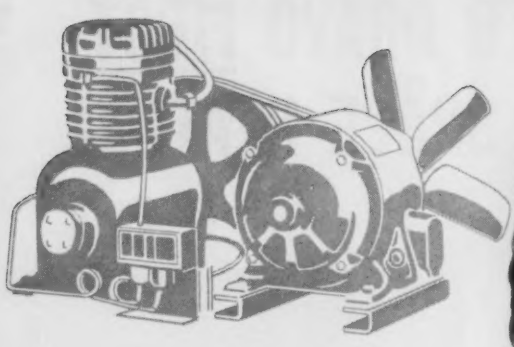
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

seal it! forget it!



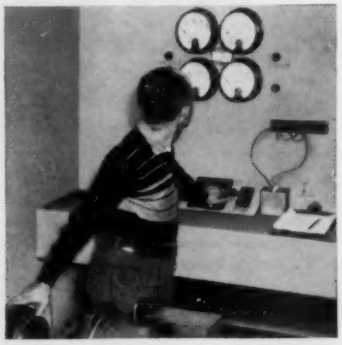
The motor is no problem when you use A. O. Smith hermetics in your air conditioning compressors

CUSTOM-ENGINEERED to operate inside hermetically sealed compressors... carefully built under controlled conditions — these A. O. Smith motors are ready to prove their dependability in your equipment.

Picture a motor manufacturing setup as clean as a food processing plant — with humidity and temperature precisely controlled the year around. *That's the picture in A. O. Smith's hermetics department. No dust or dirt to stop these motors when they work for you.*

Imagine production-line quality control in which every motor must pass the toughest electrical and mechanical tests. *That's the procedure for A. O. Smith's hermetics. Your protection against failure in service.*

Surge comparison testing machine spots shorts in the coils . . . is used to test every hermetic motor.



Torque and speed for every hermetic motor are tested under load on a dynamometer.

Through research A.O. Smith *. . . a better way*

A.O.Smith

CORPORATION

ELECTRIC MOTOR DIVISION
P. O. Box 170 • Dayton, Ohio
International Division: Milwaukee 1, Wisconsin

GET ALL THE FACTS about A. O. Smith hermetic motors — 1½ through 10 hp. Write A. O. Smith Corporation, Electric Motor Division, P. O. Box 170, Dayton, Ohio.

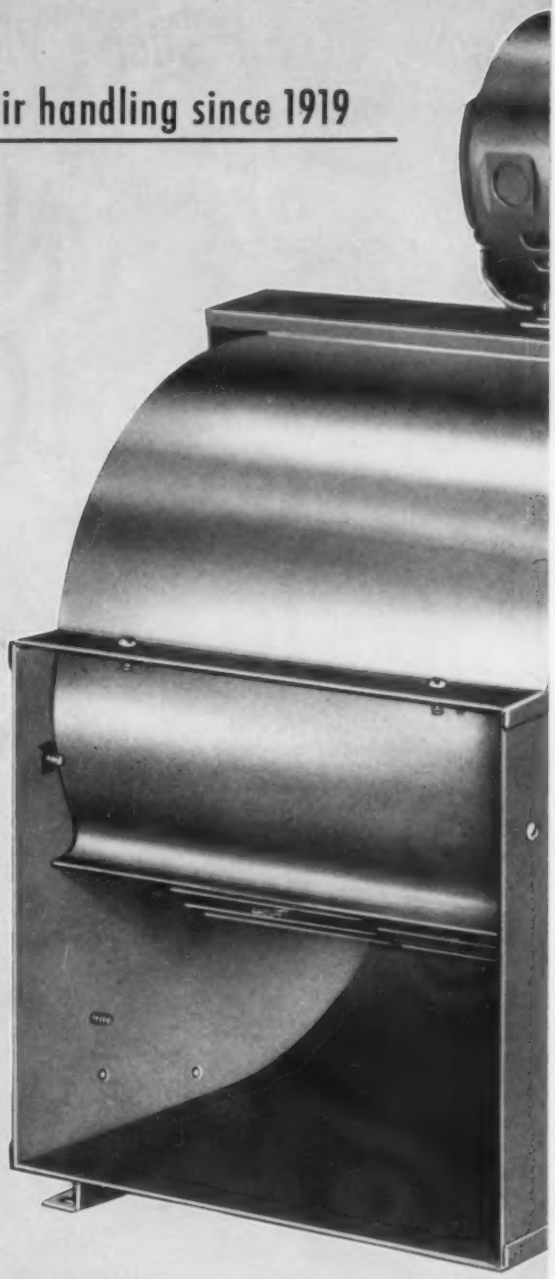
Brundage ...for better air handling since 1919

Quiet Please...

Quiet is the word for Brundage Blowers — and the key to happy customers who don't even want to know they have a blower.

Add the practically service-free performance of extra-strong construction and you have a sure hit with your dealers too.

Whether you manufacture heating or cooling equipment, you can be sure of the quality to match your finest product when you choose Brundage . . . quality proven since 1919.



ASK FOR SAMPLE BLOWERS TO PROVE BRUNDAGE VALUE IN YOUR OWN LAB.

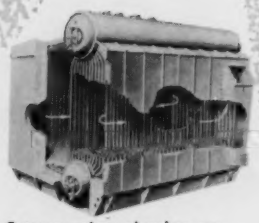
RELIABLE SERVICE — WHEN YOU NEED IT!

WRITE FOR FREE LITERATURE PRICES ON REQUEST

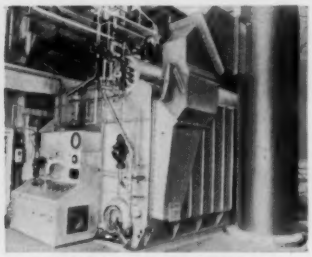
THE Brundage COMPANY
512 N. PARK STREET KALAMAZOO, MICH.
Phone 2-0251

now... Combustion's VP Boiler with a

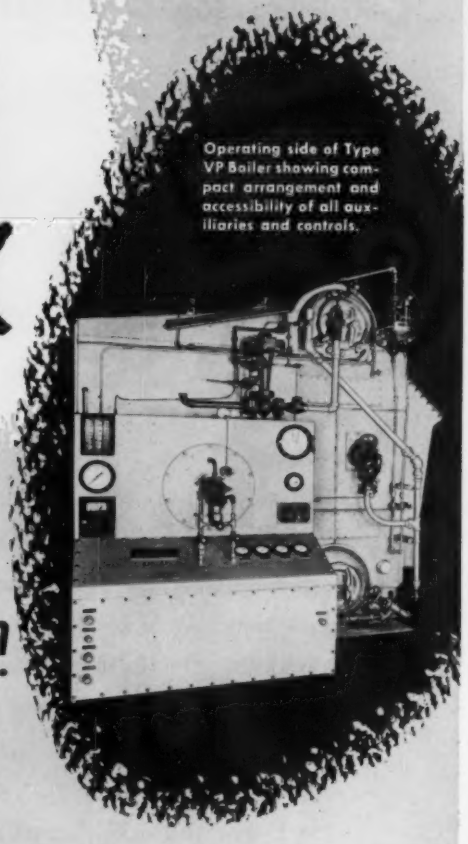
NEW LOOK



Cutaway view showing arrangement of two-pass VP Boiler.



Industrial installation of VP Boiler in the South. Capacity — 33,000 lb steam per hr; design pressure 250 psi.



Operating side of Type VP Boiler showing compact arrangement and accessibility of all auxiliaries and controls.

gives you more steam per dollar!

THE VP BOILER is available in capacities ranging from about 4,000 to 40,000 lbs of steam per hr, and pressures up to 500 psi.

Combustion's well-known C-E Package Boiler, Type VP, has a *new look* . . . outside and inside!

Outside. The VP's exterior is more streamlined, more compact. The controls and fan are now an integral part of the boiler front. Duct work is simplified. This means better appearance, easier maintenance, better operation.

Inside. Now instead of 2″ diameter tubes you'll find 2½″ tubes swaged down to 2″ at the drums — in all sizes above 15,000 lb per hr capacity. This permits closer spacing of the tube surfaces in the main boiler bank and results in up to 25 per cent more heating surface per tube. It increases mass flow rates, assuring more efficient heat transfer. All this adds to up more steam than from the former VP Boilers of the same size.

All of the existing *extra* features which contributed to the enthusiastic acceptance of the original VP design remain. Briefly summarized they are:

- **More water cooling** per unit of furnace volume than any other boiler of the VP's size and type.
- **Quiet centrifugal fan,** which operates at low speed and with an exceptionally low noise level.
- **Large lower drum,** which facilitates handling wide load swings . . . permits a simple, symmetrical tube arrangement . . . simplifies inspection.
- **Single Burner** assures balanced furnace conditions and air distribution . . . is easier to operate and to maintain . . . simple burner control equipment . . . no air leakage through idle burner . . . change oil gun, when required, in seconds.
- **Simple baffle arrangement,** which means maximum heat transfer rate . . . no dead gas pockets . . . simplified soot blowing.

The *New* VP Boiler not only looks more attractive but it is functionally improved and stands ready to deliver more steam per dollar.

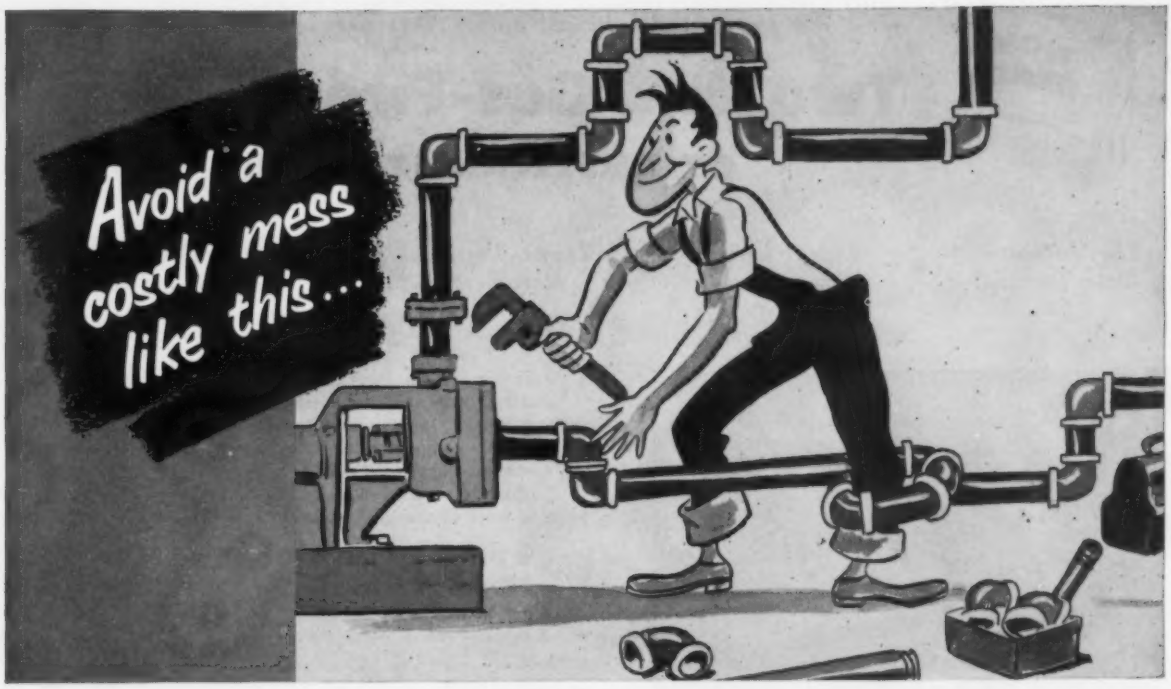
Write, today, for complete information. Ask for new catalog VP-266 (just off the press) which contains specifications and general information on dimensions, space requirements, construction details and controls.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

B-8128



Get Allis-Chalmers Engineering help on PUMPS

It pays to rely on Allis-Chalmers for your air conditioning pump needs. Your Allis-Chalmers representative or distributor is an experienced, highly qualified specialist who will help you pre-engineer the setup — help you get the simplest possible layout that will be most effective.

Get Immediate Delivery From Stock

Allis-Chalmers air conditioning pumps, in a complete range of types and sizes, are carried in stock by Regional Warehouses and Authorized Distributors throughout the country. Your representative will show you how to expedite pump selection and ordering. Contact him before you start your next job. A-4623

Milwaukee 1, Wisconsin

ALLIS-CHALMERS

so you can sell and install during the summer building season

Two New Gas-Fired Boilers

BY AMERICAN-STANDARD

They're Neater, Better Looking! • *They're Lower, More Compact!* • *They're Expandable, More Versatile!* • *They're Easier to Install and Service!*

Both the G-4 and G-6 boilers are approved by A.G.A. for all gases and comply with A.S.M.E. specifications.

MODERN in design throughout with attractive 20-gauge steel jackets, these brand-new, space-saving boilers with built-in drafthoods, are ideal for large homes, apartments, schools, office buildings and commercial buildings. They also incorporate many engineering and construction features which make for higher operating efficiency . . . as well as installation and servicing economies. Some of these advantages are listed below.

G-4

- For water or steam . . . available from 4 to 11 sections with inputs from 180,000 to 600,000 Btu per hour.
- Design based on use of multiple sections with burner for each flue passage. Factory tested burner has an input of 60,000 Btu per hour.
- Sections easily assembled . . . end sections designed with extended base to form supporting legs. Jacket encloses canopy, manifold and controls. Can be assembled after heating piping is in place.
- Pintype boiler sections—over 600 pins on each center section. Easily removed cleanout panel allows access to boiler sections without removing jacket.

G-6

- For water or steam. Available from 6 to 41 sections with inputs from 650,000 to 5,200,000 Btu per hour.
- Pintype projections—over 1200 on each center and intermediate section give heating area usually found only in much larger flat-surfaced sections. Multiple section design permits almost exact sizing of boilers to meet widest range of installations.
- Various tapping arrangements allow maximum flexibility in system piping. Smart looking jacket may be assembled after heating piping is installed. Removable access panels make boiler easy to service.
- Cast-iron base firmly supports boiler sections and burners. Facilitates installation.
- Manifold is factory assembled and rigidly fastened to base by cast-iron clamps.

For a more detailed description of these boilers, just contact your distributor or the nearest American-Standard Sales Office. Plumbing and Heating Division of American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

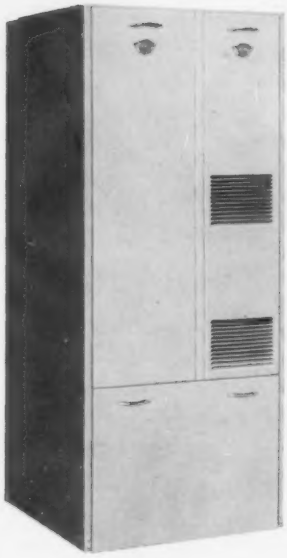
AMERICAN-Standard

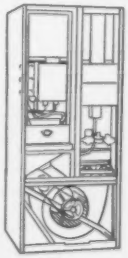
HOT WATER HEAT

Serving home and industry:

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

smooth operator with floating chassis





compact design saves floor space. floating chassis eliminates cabinet vibration.

UTILITY'S NEW COMBO-365 AIR CONDITIONER

More and more home owners are demanding a single unit air conditioner —one that cools and heats—that is compact, quiet and fully automatic. That's why Utility designed and engineered the new Combo-365. Here's year-round climate control . . . 365 days of push-button comfort.

With floor space at a premium, Utility concentrated on saving space. The two-ton/75,000 BTU model measures only 27½″ wide, 27½″ deep—about a third less than comparable capacity conditioners. The three-ton/105,000 BTU model is proportionately compact.

To guarantee quiet operation, Utility designed the "Floating Chassis" refrigeration circuit installed on resilient channels to eliminate cabinet vibration. This unique interior design also permits installing first the cabinet including the forced air furnace . . . easily adding the hermetically sealed refrigeration chassis whenever the home owner desires. Maximum airflow is assured by the large 12″ double width blower which is resiliently mounted for quiet operation. Utility's Sy-Lent* heat exchanger silences expansion and contraction noises.

Of course, Combo-365 boasts automatic controls. What could be simpler than a flip of a thermostat switch. That's all you need to change from summer to winter operation. No dampers to install. No change-over worries.

Combo-365 is an exciting new addition to modern living. For increased efficiency, trouble free operation and complete customer satisfaction, Combo-365 is a stand-out performer.

**Patent applied for*

See the complete Utility heating and air conditioning line now.

GAFFERS & SATTLER AND OCCIDENTAL
Automatic Gas Ranges
UTILITY
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Air Conditioners
Water Heaters

a happier living family tree . . . all branches of

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Please send me full information on:

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BRUNER
WATER SOFTENERS & FILTERS

for Industrial Installations

Hundreds of Bruner Industrial Water Softener installations are proving their superiority in military bases, industrial plants, hotels, hospitals, schools and colleges in all parts of the United States, Canada, Alaska and South America.

Examples of Bruner Industrial Installations:

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Halle Bros. Dept. Store — Canton, O.
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There are Bruner Sales and Engineering offices in principal cities. Your inquiry will receive immediate attention.

Manual and Fully Automatic softeners in capacities up to 1,500,000 grains are carried in stock. Larger capacities and special equipment to treat unusual water conditions engineered to meet your requirements.

BRUNER
WATER SOFTENERS & FILTERS

BRUNER Corporation

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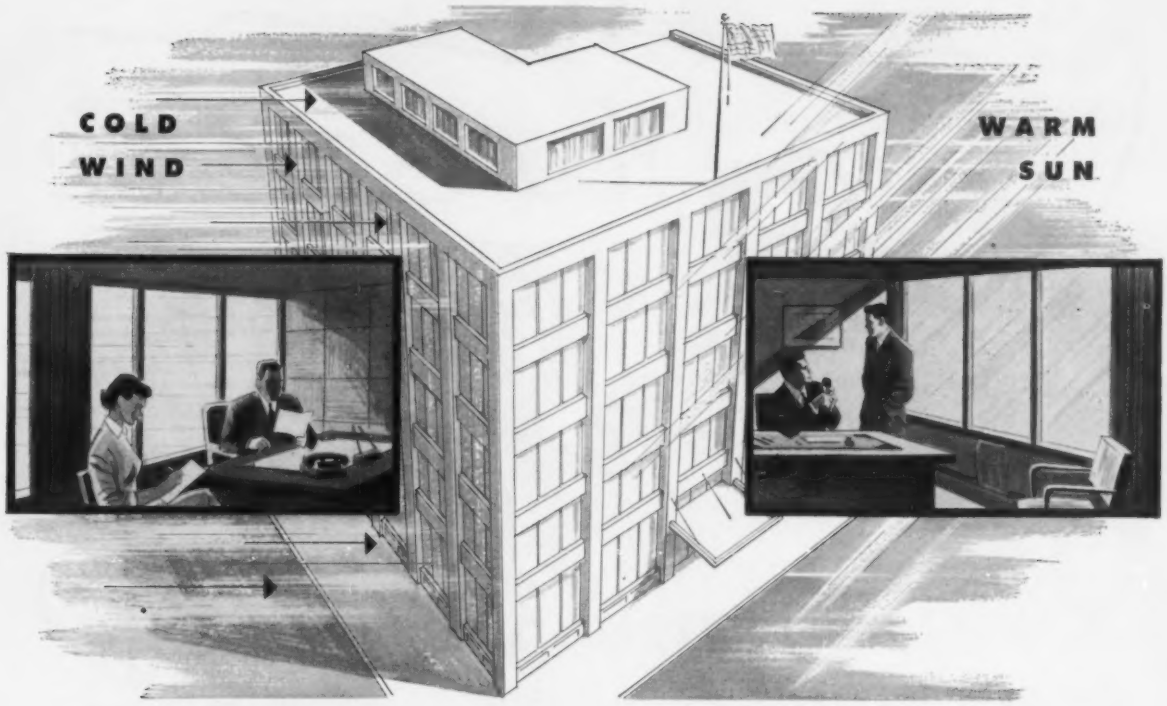
Sales Offices in Principal Cities • Plants in Milwaukee and Santa Barbara



No Heating Problem

Iron Fireman SelecTemp Heating adjusts automatically to heat loss or gain in *each individual room or office*

A thermostat in every room
When every room is a separate heating zone, a lot of problems that a conventional system can't touch are solved automatically.

Each room takes care of its own heat loss or gain, no matter how much conditions may vary in different parts of a building.

Occupants may have any temperature they choose simply by setting the thermostat in their own room or office. They use only the amount of heat they need. No space is overheated. Nor is there any wasteful heating of unoccupied space. Temperature can be reduced in any unused room, and restored to comfort level within a few minutes when needed.

Ideal for motels, hotels, apartment houses and hospitals. Every guest and tenant has his own idea of heating comfort, and is usually vocal about it. SelecTemp heating has eliminated a lot of headaches for building managers, besides making tenants happy.

Iron Fireman SelecTemp heating is especially valuable for hospitals, where it is often desirable to control room temperatures according to individual needs of patients.

Send for descriptive booklet
Iron Fireman SelecTemp heating is fully described in a booklet specially prepared for architects and builders, containing all necessary specifications. Use coupon below.

SELECTEMP HIGHLIGHTS

THERMOSTAT IN EVERY ROOM. Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

MODULATED HEAT. Air circulation is continuous. Both temperature and volume of air are automatically modulated, as required to offset heat loss from room.

FILTERED, CIRCULATED AIR. Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each room unit. Filtered outside air can be introduced if desired.

BOILER LOCATION. Boiler can be placed in any desired location, with proper distribution of heat to every room. Year-around domestic hot water coils available. Fuels: Gas, oil or coal.

LOW POWER COST. No electricity required to operate circulating fans. Nonelectric thermostats.

LOW INITIAL COST. Easily installed in either new or old construction. Small soft copper tubing (¾ inch I.D.) carries steam to individual room heater units. Return lines are ⅜ inch. Substantial savings in installation costs.

LOW FUEL COST. Temperature easily reduced in unused rooms. Overheating is eliminated.

AUTOMATICALLY BALANCED. No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

Iron Fireman®
SelecTemp®
MODULATING ZONE HEATING

Send for free booklet . . .

IRON FIREMAN MANUFACTURING CO.
3061 West 106th Street, Cleveland 11, Ohio.
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Please send literature on Iron Fireman SelecTemp heating.

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You Gave Us The Cue

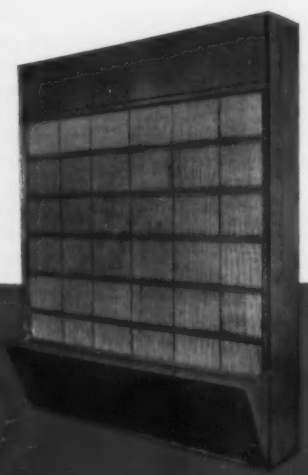
...and CONTINENTAL
came through
for you
with

A SUPERIOR AUTOMATIC SELF-CLEANING AIR FILTER

which provides "Ferris-Wheel action" and four-star performance:

- high efficiency
- low resistance
- non-clogging
- positive cleaning

Step right up and ask for your free copy of Continental's all-new 12-page, fact-filled Bulletin No. 210—all about automatic air filtering.

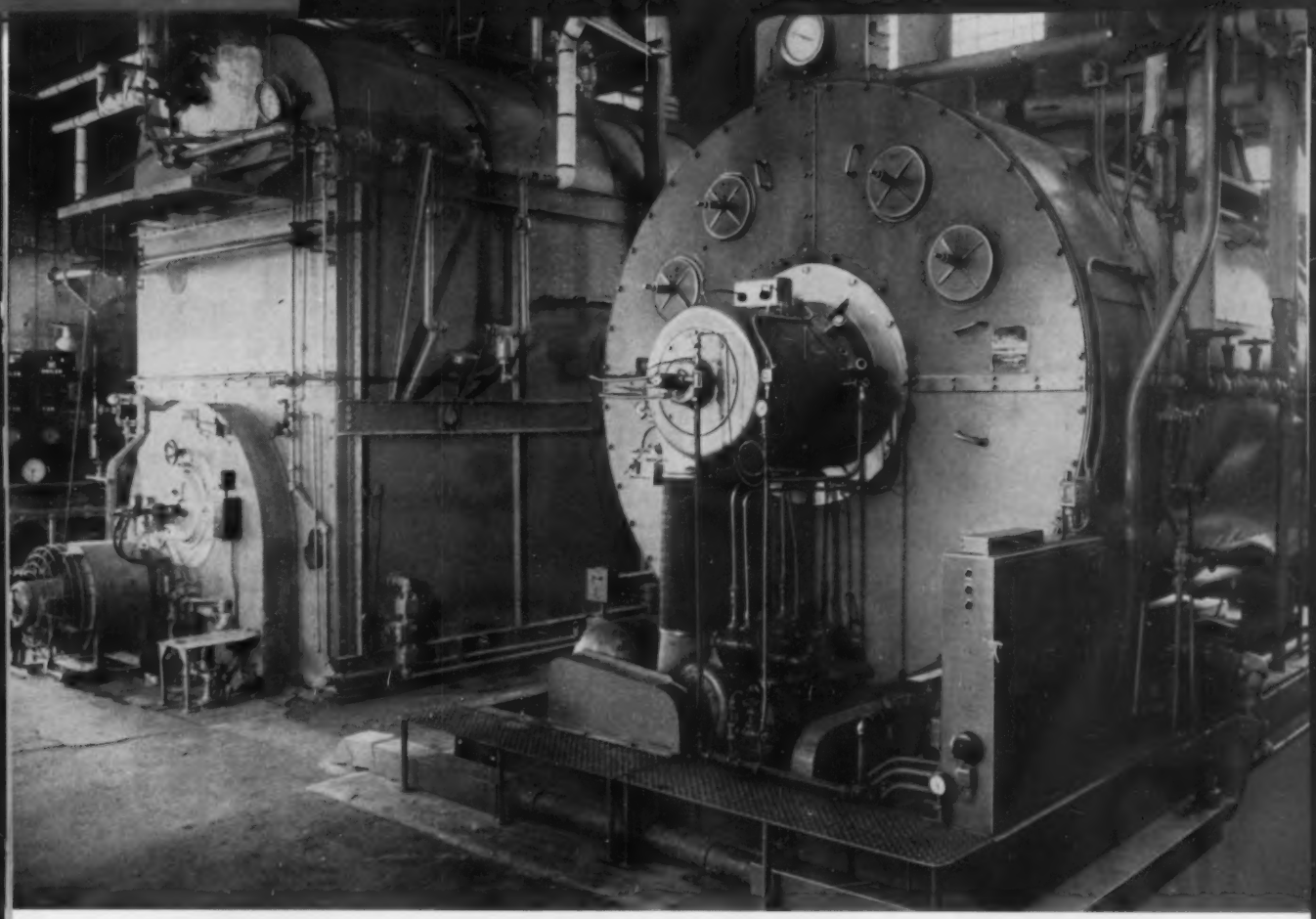


AIR CONTINENTAL FILTERS

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

AAF MEMBER



Why was this *Powermaster*® switched from "Stand-by" to Full-Time Duty?

You get MORE than fuel economy with Powermaster

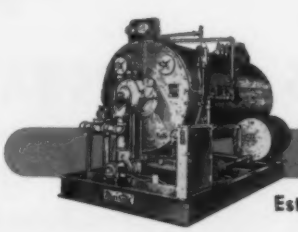
- ★ Low-cost, space-saving installation
- ★ Fast steaming
- ★ Instant response to load changes
- ★ Quick fuel change-overs
- ★ Clean, dry steam
- ★ Automatic operating and safety controls
- ★ Clean, quiet operation
- ★ Smokeless combustion
- ★ One-source responsibility for complete unit
- ★ Nation-wide factory-trained service organization
- ★ Pay-As-You-SAVE Purchase Plan

Originally purchased as a stand-by unit to supplement two older water-tube boilers, this 500 HP heavy oil *Powermaster* Packaged Automatic Boiler was quickly put on full-time duty by an Eastern rubber goods company.

The reason is *Powermaster's* fuel economy. While the *Powermaster* now carries the plant load continuously, the older boilers, one of which is shown at left above, are operated only when necessary.

Powermaster's cost-cutting and worry-saving advantages can be yours quickly and easily under Orr & Sembower's new Pay-As-You-SAVE Purchase Plan.

Write for Bulletin 1220.



Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.

ORR & SEMBOWER, INC.

Established 1885 • Morgantown Road, Reading, Pa.

...Digging for facts

ON AUTOMATIC REGULATING VALVES?

YOU'LL FIND THESE KLIPFEL BULLETINS PRACTICAL, FACTUAL AND USEFUL!

Klipfel engineers have put a lot of experience and research into these bulletins to make them useful to you . . . the man who uses or specifies automatic regulating valves. Each bulletin covers such points as: the advantages and limitations of different valve constructions; selecting the proper type valve for given operating conditions; determining the most effective and economic size valve for the job.

In short, Klipfel engineers have prepared these bulletins to assist you in selecting the type and size valve best suited to your needs.

Write Dept. B-6 for any bulletins you wish. We'll gladly send them to you.

KLIPFEL REDUCING VALVES

for steam, air and water . . . in lever and weight, air loaded, pilot control and spring loaded types; descriptions, illustrations and complete selection data in Bulletin 154 .

KLIPFEL FLOAT VALVES

Single and double seated types with direct action or pilot control for remote location. Types shown include quick-acting valves; all are available in angle and globe patterns. Bulletin 254 .

KLIPFEL THERMOSTATIC VALVES

Vapor pressure operated valves with spring or weight and lever loading. Valves are ball type, balanced cup and disc or balanced inner valves. Min. temp. 80°. Max. temp. 250°. Range limit of any instrument 40°. Bulletin 354.

KLIPFEL BACK PRESSURE AND RELIEF VALVES

For control of air, steam and water pressures at the valve inlet in various types for practically any service. Bulletin 454 gives complete details including dimensions and capacities.

Klipfel VALVES INCORPORATED

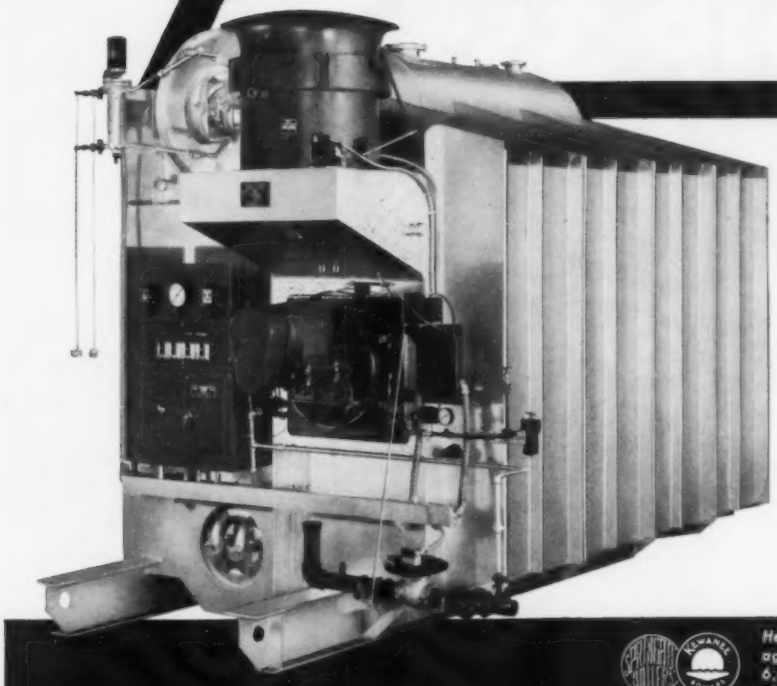
DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO

EXPORT DEPT.: 1010 SCHAFF BLDG., PHILADELPHIA, PA.

Announcing one of the most significant additions to our product line . . .

KEWANEE - SPRINGFIELD

water-tube package generator



Here it is—Kewanee-Springfield Water-Tube Package Generator available in 14 standard sizes — 6,000 to 45,000 pounds of steam per hour, or equivalent in high temperature—high pressure hot water.

Now from one source Kewanee offers you the broadest selection of boilers in the U.S.A.

When a new member is added to the family of products at Kewanee you may be sure much thought preceded such a move . . . thought of how you could better be served.

So with years of research and practical field experience behind us, we present the Kewanee-Springfield Water-Tube Package Generator. Manufactured by the Springfield Boiler Company and marketed coast-to-coast by Kewanee, it means from 1 source Kewanee now brings you the broadest selection of boilers in the U.S.A.

The Kewanee-Springfield Water-Tube Package Generator is the most compact power plant type unit. Specially selected, durable materials plus 2 drum bent tube design makes for maximum use of boiler space to deliver the greatest steam output. Steel encased—a complete unit with no extras required. Exclusive "6 wall" cooling permits high heat release rates.

All this adds up to lower operating cost . . . less fuel is required to deliver heat due to smaller heating surface with higher heat absorption. Maintenance cost is lower, too . . . double panel casing construction makes tubes easily accessible. Guaranteed maximum continuous capacity . . . can operate at peak loads without interruption.

KEWANEE-ROSS CORPORATION, Kewanee, Illinois

(Division of American Radiator & Standard Sanitary Corporation)

Serving home and industry · American-Standard · American Blower
Church Seats & Wall Tile · Detroit Controls · Kewanee Boilers
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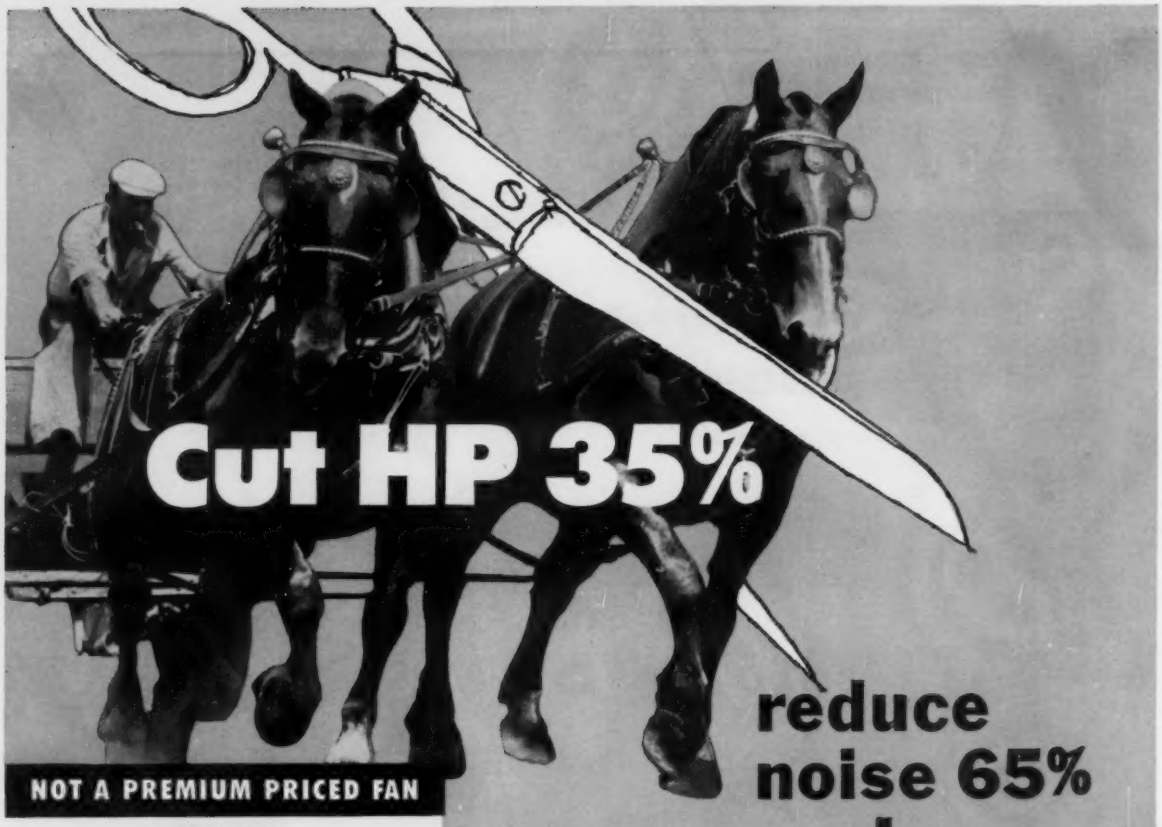
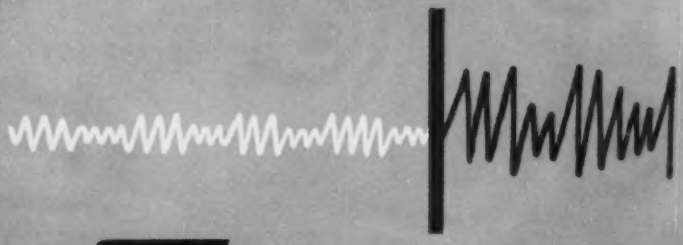
YOU can depend on KEWANEE-SPRINGFIELD engineering



Cut HP 35%

reduce noise 65%

NOT A PREMIUM PRICED FAN

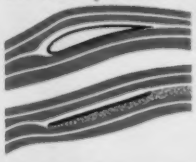


CHICAGO AIRFOIL FANS

Comparative air flow patterns

New airfoil blade

Old-fashioned flat blade



FREE CHART!
Shows how to save H. P.

Aerodynamically designed blades of the CHICAGO Airfoil Fan are shaped on the same principle as the wings of a modern jet plane—to give greater "lift" with less air turbulence. Certified ratings show CHICAGO Airfoil Fans move more air with up to 35% less H. P. and 65% less noise level.

Efficiencies of 92% are unequalled for industrial and commercial heating and ventilating, high pressure air conditioning and forced draft applications.

Class I to Class V. All drive arrangements.

600 to 1,000,000 CFM at ⅛" to 32" static pressure.

Wheel diameters 12" to 143".

See your local classified directory under "Fans-Blowers" for nearest "Chicago" Engineer

CHICAGO BLOWER CORPORATION
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☐ Send Free Power Evaluation Chart.
☐ Have representative deliver Bul. A-102.

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EXPANDED

CHICAGO'S

Enlarged Line of

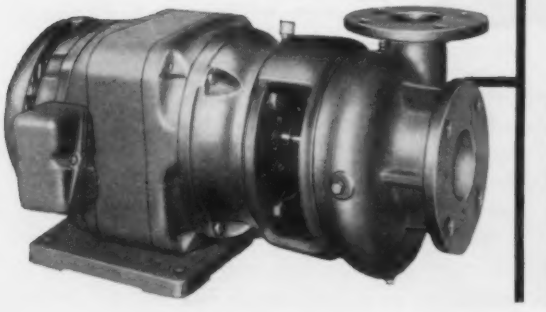
FC FLEXIBLE-COUPLED and CC CLOSE-COUPLED Pumps

Gives You

More Choices, More Efficiency

Designed for:

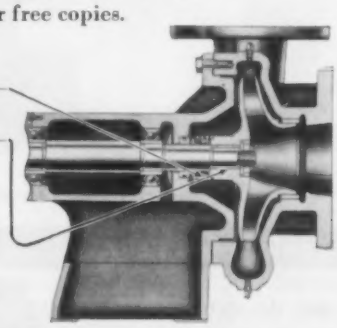
- Water Supply Systems
- Cooling Tower Circulating
- Air Conditioning Systems
- Hot and Chilled Water Circulating
- Pneumatic Water Systems
- Booster Service



However specialized your need for a circulating pump, you are sure to find the model and size that exactly fits your requirements in Chicago's recently expanded centrifugal pump line. Now you can get high efficiency Chicago pumps in either close-coupled or flexible-coupled models with capacities from 5 to 400 G.P.M. and for heads from 10 to 190 feet. Complete line is described in two new bulletins, Nos. 107 and 108. Write to Dept. D for free copies.

FEATURING THE CERAMIC-FACED SEAL AND SHORT OVERHANG IMPELLER

All Chicago C-C and F-C pumps are equipped with the most reliable mechanical seal ever built into a pump! Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. No troublesome packing replacement and maintenance, no shaft wear commonly found with stuffing box seals.



Silence Built-In

Ball bearings close to the end of the impeller insure ample support and alignment for quiet operation always. Impeller is perfectly balanced for vibrationless, noiseless rotation.

fmc

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

BUILDING PUMP DIVISION

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Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every Industrial use.

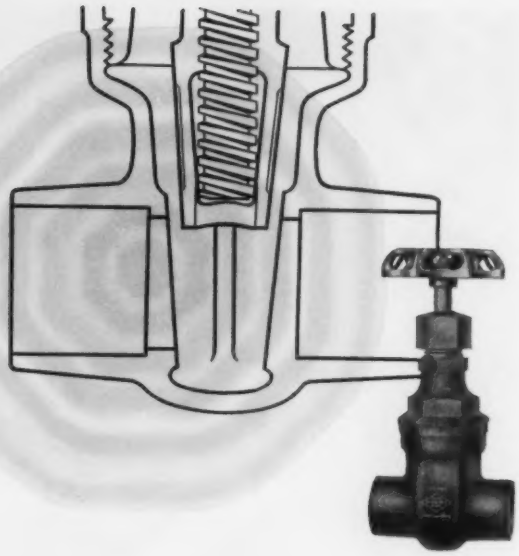
When the heat's on

you need the extra strength of

JENKINS

Solder and Socket End

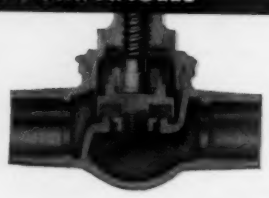
VALVES



Solder End GLOBES and ANGLES

300 lbs. O.W.G.
¼" to 3"

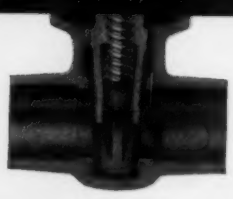
Fitted with Renewable Composition Disc.



Solder End GATES

225 lb. and 300 lb. O.W.G.
⅜" to 3"

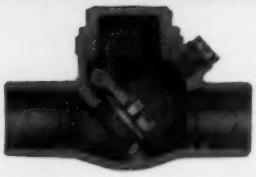
With solid or split wedges, and stationary or traveling spindles.



Solder End CHECKS

300 lbs. O.W.G.
¼" to 3"

Regrinding. May be easily reground without removal from line.



NEW BULLETIN Lists all Jenkins Solder End and Socket End Valves and gives complete instructions for soldering and brazing. Ask for Solder-Socket End booklet.

The "light-duty" look of copper tubing installations is deceiving. Valves must provide an accurate fit to tubing and *hold it* under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, valves must withstand unusual strains in operation.

Jenkins Solder End Valves are engineered to meet these demands with strength to spare. High tensile bronze castings have liberal dimensions for extra rigidity. Smooth, clean bores assure accurate fit, easy soldering, positive seal to types K, L, and M Copper Tubing.

For faster, trouble-free installation, and lasting economy, specify Jenkins Solder End Valves. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS Socket End Valves

for Class B or IPS Tubing

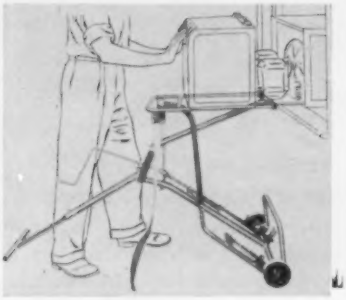
Jenkins bronze valves with socket ends for silver-brazing are made in Globe, Gate, and Swing Check patterns to control compressed air, hot oil, and similar fluids in tubing hookups where specifications call for permanent, leakproof joints. Complete information in the Bulletin offered below.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 252



Elevating Truck . . .

. . . for air conditioner installation—Fairbanks Co., 393 Lafayette St., New York. One man hand truck designed to deliver, install, service. Is said to be time, money saver. Elevates to 43 in. above floor level. Folds into package. Weighs 49 lb. Shown is truck tilted back with conditioner being slid into window frame.

Ball Joints . . .

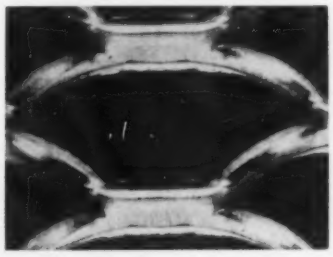
. . . of prefabricated sheet metal flexible design—Spincraft, Inc., 4132 W. State St., Milwaukee. In eight pipe sizes, 3 to 12 in. diameter. For exhaust, blower systems in ventilating, air conditioning. Only 25 percent of weight of cast iron ball joint, says company.

Heat Exchangers . . .

. . .in two types for varied applications — Bell & Gossett Co., Morton Grove, Ill. "SU" exchangers designed for heating liquid with condensing steam. For 150 psi. Primarily for heating capacities from 16 to 1200 gpm. Also as heater for other liquids. "WU" units use boiler water for heating. Used as heater, condensate cooler. For 150 psi.

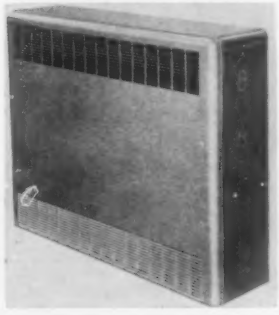
Flexible Connector . . .

. . . designed to permit travel, absorb vibration, connect misaligned ports in pipe lines—American Brass Co., American Metal Hose Branch, Waterbury 20, Conn. Has standard plated brass pipe fittings at each end. Designed for wet heating, trouble spots in commercial, industrial piping. Sizes: ¼ to 2 in. ID.



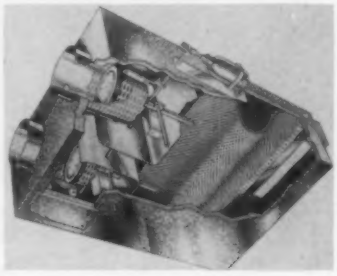
Air Filter . . .

. . . with air openings in medium stamped to predetermined tolerance —George Evans Corp., Moline, Ill. Every filter has same number of "air scoop" openings, says company. Has larger openings on inlet side progressing to smaller ones on outlet side. Unit designed to hold more dirt without restricting airflow. All aluminum construction.



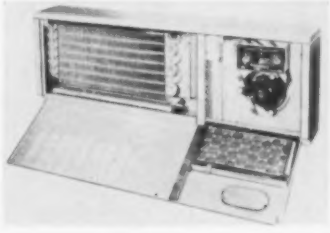
Unit Heaters . . .

. . .with cabinet type design — C. A. Dunham Co., 400 W. Madison St., Chicago. In seven styles. Can be mounted various ways. Rubber mounted motor designed for quiet operation. Fans mounted directly on two speed motor.



Air Diffuser . . .

. . .with dual duct high pressure design for temperature, volume control — Connor Engineering Corp., 500 5th Ave., New York 36. Air delivery, once established, remains uniform, while temperature is varied by mixing hot, cold air quantities. Inlets fitted with dampers of double perforated concentric sleeves, felt edged pistons. Outer sleeves slide back and forth over fixed inner sleeves, proportioning hot and cold air, controlling final temperature. In capacities to 1000 cfm.



Dual Conditioner . . .

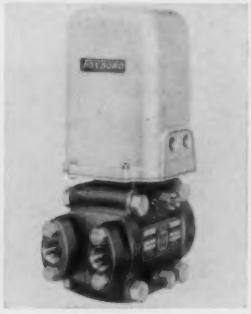
. . .with baseboard design for multiroom installations — Circle Air Industries, Inc., Brooklyn 16. Operates on same piping circuit used for heating. Requires no ducts. Each unit has own zone control. Capacities: 5400 to 7900 Btu for cooling: 10,400 to 16,000 Btu for heating. To complete year 'round system, water chiller supplied to operate with boiler.

Cell Transmitter . . .

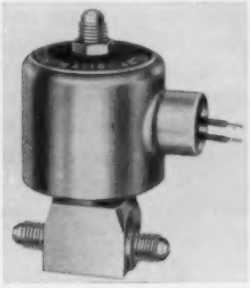
. . . for process flow measurement—Foxboro Co., Foxboro, Mass. Measures differential pressures, transmits 3 to 15 psi signal to receiving, recording or controlling instrument. Pro-

EQUIPMENT DEVELOPMENTS

Continued

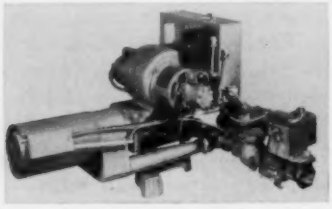


vides continuous adjustment over range of 0 to 50 in. to 0 to 250 in. of water differential without change of parts. Of three basic parts: body, transmitter, air relay. Operates on force balance principle.



Solenoid Pilot . . .

. . . control for ¼ in. SAE male flare connections—Sporlan Valve Co., 7525 Sussex Ave., St. Louis 17. Designed for use in place of large capacity solenoid valves for shutoff of liquid lines. For Freon 12 and 22, Carrene 7, Methyl Chloride. Does not directly close liquid line, but acts on thermostatic expansion valve causing it to close.

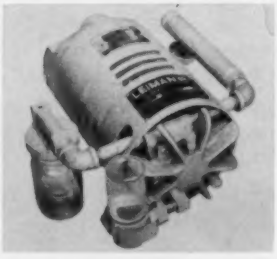


Gas-Oil Burner . . .

. . . operates on city gas, No. 2 oil — Roberts-Gordon Appliance Corp., 44 Central Ave., Buffalo 6. In three sizes for inputs 360,000 to 4,300,000 Btu per hr. Designed for easy installation, adjustment, service. Automatic or manual fuel switch-over. Furnished with diaphragm gas valve, gas pressure regulator, barometric draft regulator, main shutoff valve, pilot flame electrode, photo cell for oil.

Balancing Valve . . .

. . . adapter fitting for angle balancing of hot water heating, chilled water cooling systems—Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41. When sweated into run of ¾ or 1 in. cast brass tee, adapter completes angle balancing valve, says company. Is said to provide full free flow of water through tee.

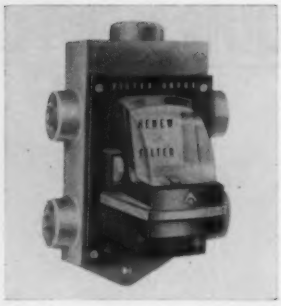


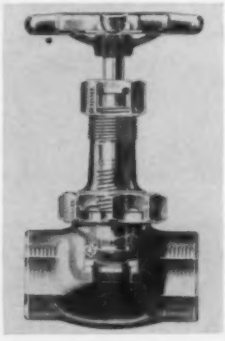
Air Pump and Motor . . .

. . . unit with higher capacity — Leiman Bros., Inc., 102 Christie St., Newark 5. Model "K-3" is said to provide 28 in. Hg continuous vacuum, 20 lb pressure, have 7.2 cfm displacement. Features ball bearing motor, rotary pump. Fan cooled, mounted on rubber silencers.

Air Filter Gage . . .

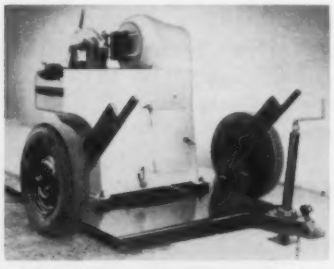
. . . for industrial, commercial ventilating, air conditioning systems—Bacharach Industrial Instrument Co., 7301 Penn Ave., Pittsburgh 8. Designed to monitor dust removal efficiency of air filters. Operates on principle of differential pressure measurement. When differential due to dirt becomes excessive, "renew filter" signal flips into view. Gage operates between 0.06 and 3.5 in. of water differential pressure.





Bronze Globe Valve . . .

. . . features new seating metal, flat seat design — Lunkenheimer Co., Box 360, Cincinnati 14. "Brinalloy" alloy designed to be wear- and corrosion-resistant. Seat is said to last lifetime of valve. Different exterior design, above.



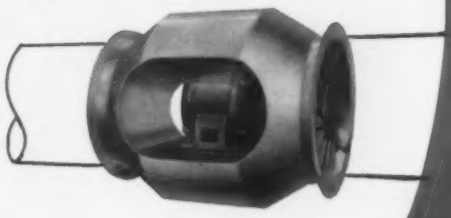
Mobile Pipe Shops . . .

. . . for on the job cutting, threading of pipe—Gaines-Collins, 5474-78 Alhambra Ave., Los Angeles 32. Trailer hitched to car, truck. "Thread-O-Matic" features power operated automatic chuck, multispeed transmission.

BIFURCATOR FAN EFFICIENTLY EXHAUSTS HOT, CORROSIVE, FLAMMABLE AND EXPLOSIVE FUMES

Bifurcator Fans exhaust fumes at *top efficiency* by avoiding a directional change in the air stream. Other fans often require a 90° change in direction of the exhaust stream with resultant loss in efficiency.

The fan motor stays clean, cool and accessible. Fumes are by-passed (bifurcated) around the motor chamber which is completely isolated from the exhaust stream.



Bifurcator Fan installs just like a section of ductwork.

A Bifurcator Fan is easily installed . . . just like a flanged section of ductwork. It can be mounted horizontally, vertically or at an angle. Lightweight and extremely compact, a Bifurcator requires no platform or supports. Bifurcators are available in sizes from 1140 CFM (12" diameter fan with 1/20 HP motor) up to 45,000 CFM (48" diameter fan with 20 HP motor). Housings and fan wheels can be fabricated of non-corrosive metals, or can be protected with a variety of corrosion-resistant coatings.

Be ready with the facts about Bifurcators next time you have a fume removal problem. Fill in and mail the handy coupon below . . . TODAY!

"DESIGN DATA FOR EXHAUST SYSTEMS" This helpful bulletin contains details, simplified data and charts. Compiled by Allen D. Brandt, Senior Sanitary Engineer, U. S. Public Health Service. Mail coupon for your FREE copy and Bifurcator Bulletin.

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Please send me "Design Data for Exhaust Systems" and Bifurcator Bulletin DB-4-52.

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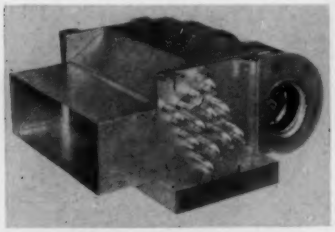
CITY _____ ZONE _____ STATE _____

NAME AND TITLE _____

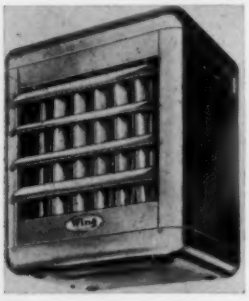
EQUIPMENT DEVELOPMENTS

Continued



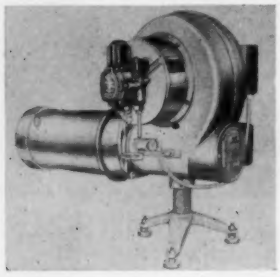
Air Conditioner . . .

. . .for remote ceiling installation — International Mfg. Co., Oklahoma City. Cabinet 11 in. high. Requires no ductwork. All aluminum construction. Motor, blower assembly lifts out. Each unit individually controlled but operates from central chilled water system.



Utility Heaters . . .

. . .with horizontal discharge — L. J. Wing Mfg. Co., Linden, N. J. Gas fired. Built-in draft diverter. Aluminum propeller type fans. Range from 50,000 to 230,000 Btu per hr input.

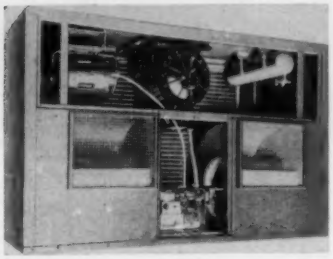


Oil Burner . . .

. . .is pressure atomizing type with 20 to 30 gal capacity—Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11. For firing No. 2 or lighter oil. Features heavy duty choke ring, cast iron frame, sealed motor, electronic combustion controls.

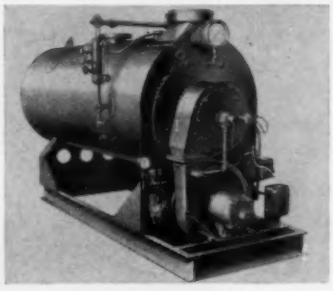
Filter-Drier . . .

. . . for removal of pipe scale, core sand, other abrasives on ammonia systems—Sporlan Valve Co., 7525 Sussex Ave., St. Louis 17. "Catch-Alls" used as scale traps. With ½, ¾, 1 in. FPT connections. Replaceable core type. Sizes range from 1 core, 48 cu in. to 4 core, 192 cu in.



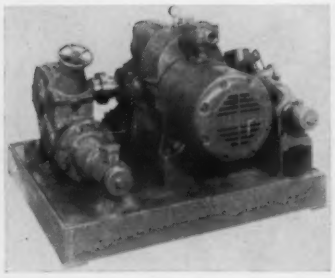
5 HP Condenser . . .

. . .designed for waterless air conditioning for commercial buildings — United States Air Conditioning Corp., 3300 Como Ave., S.E., Minneapolis 14. Provides cooling alone or converts existing warm air heating system to year 'round air conditioning. Remotely installed. Used with housed direct expansion cooling coil or coil and blower combination. Component parts include compressor, motor, receiver, condensing coil.



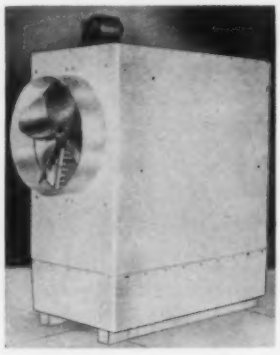
Generator . . .

. . . with combination steam, hot water service for industrial use—Cyclotherm Div., National-U. S. Radiator Corp., Oswego 1, N. Y. Basically hot water, adjustments convert to steam. Operates on light oil, gas, or combination. Rated at 60 hp. As hot water generator, delivers 2,010,000 Btu per hr. Working pressure is 30 psi. As steam unit, will generate 2,070 lb per hr of steam. Available with pressure ratings 15 to 200 psi.



Pump . . .

. . .for pressures to 50,000 psi—Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18. Designed for high pressure syntheses, hydrostatic pressure fluid metering. Complete scavenging of liquid end displacement chamber provided at all plunger stroke length settings, says company. Seven units offered ranging 7500 to 50,000 psi.



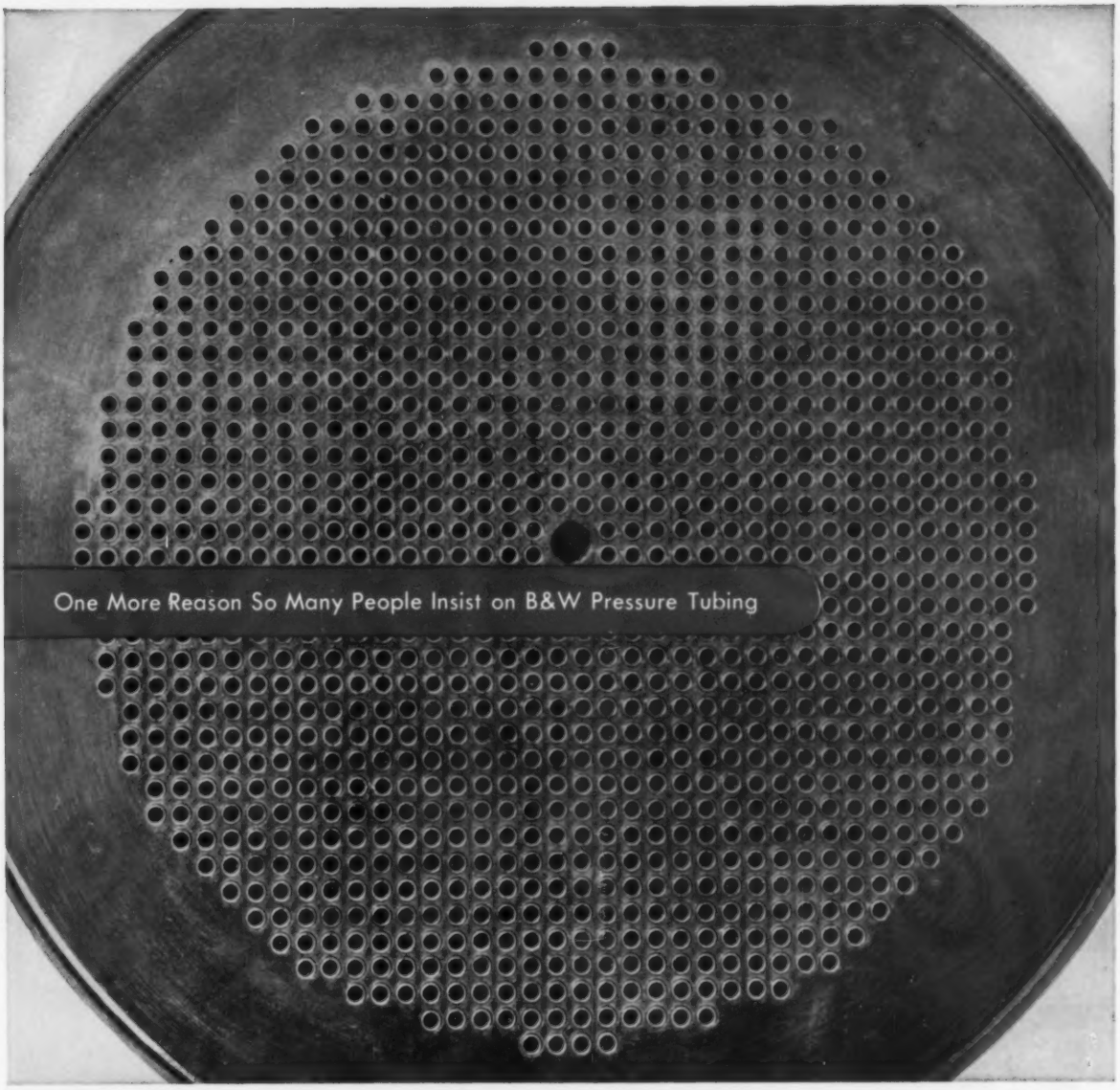
Cooling Tower . . .

. . . of glass fiber construction—Baldwin-Ward Mfg. Co., Ottawa, Kan. Designed to solve rust, corrosion, deterioration problems. Requires no weather-resistant coating. Of three pieces: upper and lower water basins, main housing. California redwood fillings. Presently available in 3 to 10 ton sizes. Sizes to 25 tons in making.

Variable Speed Pulley . . .

. . .provides ratios to 3 to 1 at 7½ to 15 hp — Lovejoy Flexible Coupling Co., 4987 W. Lake St., Chicago 44. Changes speed while machinery in motion. Standard bores 1¼, 1⅜, 1⅝ in. Other specifications include: 13.1 maximum, 4.35 minimum pitch diameter; length of bore 3¾ in.

(*Continued on page* 227)



B&W TUBING UNIFORMITY – MULTIPLIED 1194 TIMES

If you had this many tubes to roll in, there would be no delay if you used B&W tubes.

For heat exchangers, for condensers, in fact for every pressure tubing application, you can rely on B&W tubing for uniform wall thickness, uniform ductility, tight joints, and low installation cost.

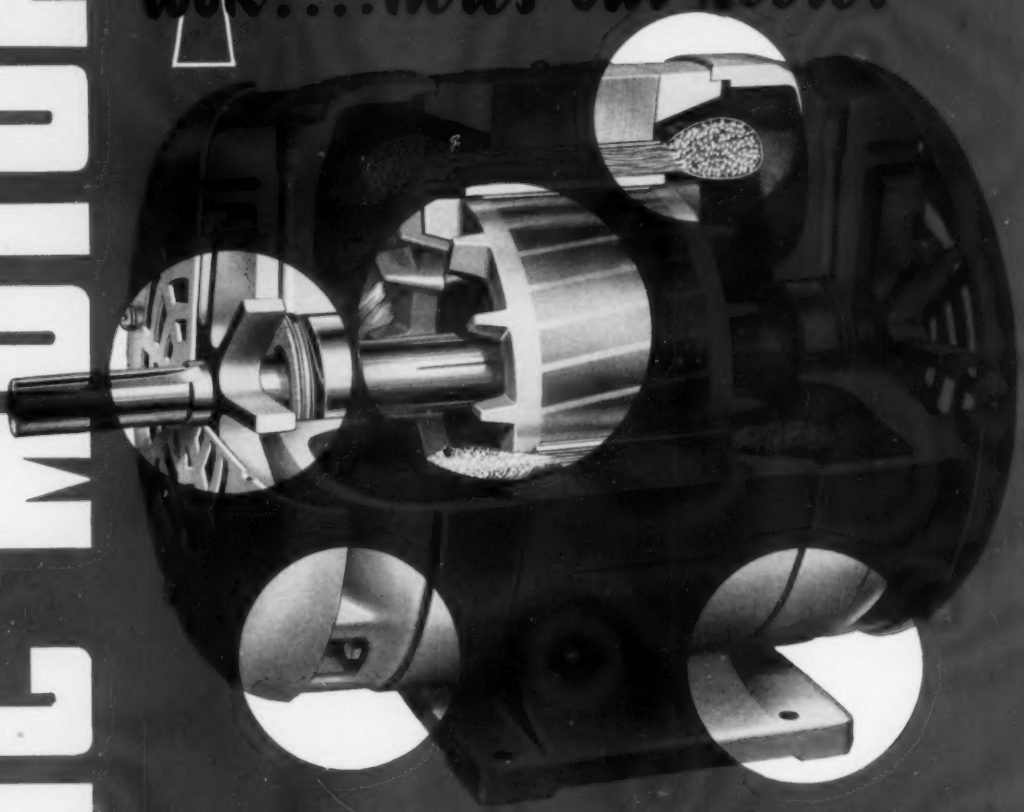
Always specify B&W pressure tubing. It meets all dimensional and mechanical requirements, and is available, in all commercial sizes, in a wide range of carbon, alloy and stainless grades. *Write for Technical Bulletin* 329-HP

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa. and Milwaukee, Wis.: Seamless Tubing, Welded Stainless Steel tubing
Alliance, Ohio: Welded Carbon Steel Tubing
Milwaukee, Wis.: Seamless Welding Fittings

TA-5019(P)

BALDOR MOTORS

look....here's our secret



The new *Streamcooled* Baltric 800 of fully enclosed motors are better because they bring you power-houses in a more compact package. And this cutaway drawing shows you how our engineers combined the newest developments and newest materials to get more motor into less bulk. The *Streamcooled* Baltric line doesn't waste an inch or an ounce. These motors are easier to install, easier to handle . . . bring you modern efficiency and performance.

See how the rugged Unicast stator frame combines steel laminations in an aluminum alloy casting to get greater stability, rigidity. Improved insulation permits better slot design for copper windings. Improved techniques produce balanced, stress-free rotors. *Every* detail of design and construction is calculated to reduce size and weight without sacrificing performance and efficiency.

And Baldor has done just that. Built a better motor. *Streamcooled* Baltric's your best bet . . . doesn't waste space . . . doesn't waste weight . . . easier to handle and install. 4555-1

Original *Streamcooled* Baldor Motors Available — Built to Former NEMA Standards

BALDOR ELECTRIC COMPANY

Baltric Motors Are Available in Polyphase • Squirrel Cage Induction and Single Phase • Capacitor Start • Induction Run Types

4353 DUNCAN AVENUE • ST. LOUIS 10, MISSOURI

For medium and high pressure piping — FLEXON EXPANSION JOINTS

FREE FLEXING TYPE — Available in sizes from 3" through 48", I.D. in copper or stainless steel. Suitable for pressures from vacuum to 30 psi and temperatures from —20° F. to 850° F. Flanges or welding ends.

CONTROLLED FLEXING TYPE — Available in sizes from 3" through 24", I.D. with copper or stainless steel pressure carrier and cast iron control rings. Suitable for pressures from vacuum to 300 psi and temperatures from —20° F. to 850° F. Flanges or welding ends.

SPECIAL TYPES — A variety of assemblies are available for special requirements including special very high pressure units for pressures to 5500 psi. For recommendations send an outline of your requirements.

DESIGN GUIDE — The Flexon Expansion Joint Design Guide is a 24 page handbook on the selection and application of expansion joints. Write for your free copy, today.

● The problem of controlling expansion in heating lines can now be solved economically. You can put an end to leakage that often results from uncontrolled expansion. At the same time you will minimize annoying pipe creeping noises. All-in-all, you can put together a vastly improved heating system at a very small increase in cost. And you can do all this with FLEXON Expansion Compensators.

The FLEXON Expansion Compensator consists of a two ply corrosion resistant bellows with copper tube end connections. The bellows section is enclosed in a floating protective shroud. The unit is designed to handle axial motion up to ½" and is suitable for temperatures from —60°F. to 300°F., pressures up to 40 psig. Sizes are ¾", 1", 1¼" and 2". The 2" size has threaded fittings. Threaded fittings are also available on smaller sizes.

Check the advantages of FLEXON Expansion Compensators on your next job. But first, get further information from your Flexonics representative or use the coupon below to get your copy of a descriptive bulletin.

Flexonics *Corporation*

Flexon identifies products of Flexonics Corporation that have served industry for over 53 years.

EXPANSION JOINT DIVISION
1391 S. Third Avenue
Maywood, Illinois

Flexonics Corporation 6-55
1391 S. Third Ave.
Maywood, Ill.

Please send me the bulletin which describes and gives full specifications for the Flexon Expansion Compensator.

Name .....

Company .....

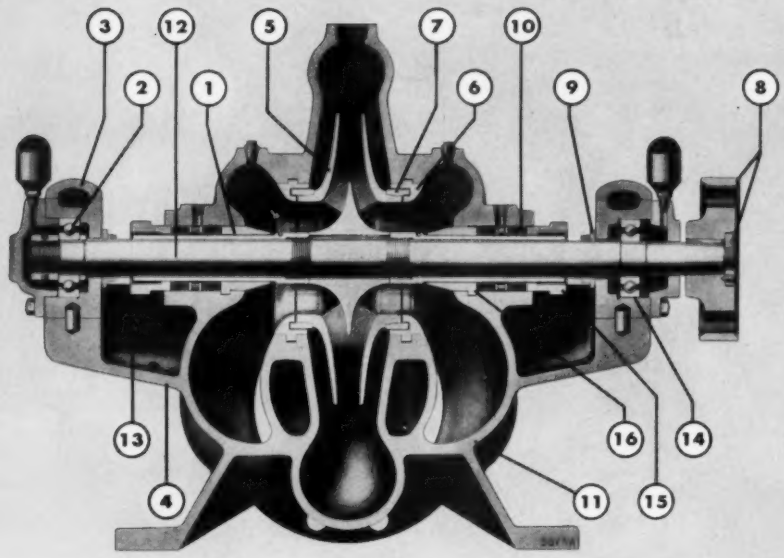
Address .....

City ..... Zone .... State .....

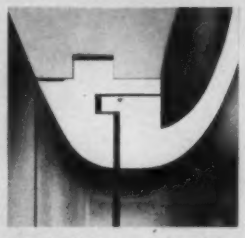
My Wholesaler is: .....

DE LAVAL
SINGLE STAGE
CENTRIFUGAL PUMPS

for dependable industrial service



Labyrinth wearing rings minimize leakage...maintain high efficiencies



Labyrinth rings used in these De Laval pumps retard flow of water through labyrinth passage.

Flat rings showing relatively unimpeded flow of water.

(1) **Shaft Sleeves** are screwed on, to abut the impeller and make a water-tight joint. Sleeve expands freely and independently of shaft when temperatures change. There is no tendency to buckle.

(2) **Thrust Bearing** locates rotor axially.

(3) **Bearing Caps** easily removable for maintenance.

(4) **Bearing Brackets** scraped to lining bars for perfect alignment.

(5) **Impeller** hydraulically balanced, finished on all surfaces.

(6) **Labyrinth Wearing Rings** held accurately in machined grooves in both case and cover.

(7) **Impeller Wearing Rings** threaded on impeller, opposite to rotation.

(8) **Flexible Coupling** ground on all exposed surfaces and statically balanced, complete coupling supplied, pump half mounted on taper so that it can be easily removed. Check nut locks coupling on taper.

(9) **Deflector** keeps water out of bearing.

(10) **Stuffing Boxes** extra deep; lantern rings for water sealing.

(11) **Pump Case** horizontally split; machined to limit gages.

(12) **Steel Shaft** ground to limit gages.

(13) **Drip Boxes** large; provided with drain openings.

(14) **Radial Bearing** free to move axially, thus avoiding temperature strains.

(15) **Glands** split horizontally.

(16) **Protecting Bushings** renewable.

You can count on the performance of the De Laval Single Stage Centrifugal Pumps because they are precision-made to high manufacturing standards and incorporate the many quality design features shown in the cross-section.

They operate at high or low speeds, at high or low heads...with maximum efficiency.

For example, De Laval G, I and K Single Stage Double Suction Pumps have a capacity range of 175 gpm to 6,000 gpm, and heads to 300 feet. They are available in sizes ranging from 4" suction and 3" discharge to 14" suction and 12" discharge. Write for Bulletin 1002.

DeLaval also furnishes larger centrifugals for capacities up to 70,000 gpm.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL 198

Clip and Save for Ready Reference

FAST FACTS ABOUT genetron® Super-Dry Refrigerants

"Genetron" *Super-Dry* Refrigerants are made by General Chemical Division, Allied Chemical & Dye Corporation, one of America's great producers of industrial and scientific chemicals for more than 50 years. Long a leader in fluorine chemistry, General has the mines, resources, reserves, experience and production facilities that make it a reliable source of fluorinated hydrocarbon refrigerants.

Careful control in the manufacture of "Genetron" refrigerants guarantees products of the highest quality, extremely low in moisture and other impurities. "Genetron" Refrigerants are identical and interchangeable in all respects with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer meeting the same high quality refrigerant standards and specifications. They have been tested exhaustively by major manufacturers and are being used in their air conditioning and refrigeration equipment.

- **Guaranteed: Exceptionally low moisture content**
- **Non-corrosive to standard equipment materials**
- **Non-toxic, non-flammable, stable, safe**
- **Critical and freezing points well outside range of operating uses**
- **Solvent action on oil helps prevent solidification or congealing of lubricant**
- **Miscible with oil; aid in lubrication of equipment**

genetron 11 ORANGE LABEL — Trichloromonofluoromethane

genetron 12 WHITE LABEL — Dichlorodifluoromethane

genetron 141 GREEN LABEL — Monochlorodifluoromethane

Selected Physical Data

	CCl_3F	CCl_2F_2	$CHClF_2$
Chemical Formula			
Molecular Weight	137.4	120.9	86.5
Boiling Pt. (°F) at 1 Atmosphere Pressure	74.7	−21.6	−41.4
Evaporator Pressure at 5°F (p.s.i. absolute)	2.93	26.52	43.02
Condensing Pressure at 86°F (p.s.i. absolute)	18.3	108.0	174.5
Freezing Point (°F) at 1 Atmosphere Pressure	−168.0	−247.0	−256.0
Critical Temperature (°F)	388.4	232.7	204.8
Critical Pressure (p.s.i. absolute)	635	582	716
*Compressor Discharge Temperature (°F)	113	102	131
Compression Ratio (86°F/5°F)	6.24	4.08	4.06
Liquid Viscosity at 5°F (centipoises)	0.650	0.328	0.286
Liquid Viscosity at 86°F (centipoises)	0.405	0.251	0.229
Vapor Viscosity at 1 atm. and 5°F (centipoises)	0.0096	0.0114	0.0114
Vapor Viscosity at 1 atm. and 86°F (centipoises)	0.0111	0.0127	0.0131
Saturated Liquid Density at 5°F (lbs./cu. ft.)	97.88	90.00	83.34
Saturated Liquid Density at 86°F (lbs./cu. ft.)	91.38	80.63	73.36
Saturated Vapor Density at 5°F (lbs./cu. ft.)	0.0815	0.6735	0.8034
Saturated Vapor Density at 86°F (lbs./cu. ft.)	0.4461	2.569	3.213
Specific Volume of Vapor at 5°F (cu. ft./lb.)	12.27	1.485	1.246
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	84.0	69.5	93.5
Net Refrigeration Effect of Liquid 86°F/5°F (B.t.u./lb.)	67.5	51.1	69.3
Specific Heat of Liquid at 86°F (B.t.u./lb. °F)	0.209	0.243	0.335
Specific Heat of Vapor at Constant Pressure of 1 atm. and 86°F (B.t.u./lb. °F)	0.13	0.14	0.15
Specific Heat Ratio at 86°F at 1 atm. (k = Cp/Cv)	1.14	1.14	1.18
*Coefficient of Performance	5.00	4.69	4.65
*Horsepower/Ton Refrigeration	0.943	1.005	1.016
*Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.96	3.91	2.89
*Liquid Circulated/Ton Refrig. (cu.in./min.)	56.0	83.8	68.1
*Compressor Displacement/Ton Refrig. (c.f.m.)	36.3	5.81	3.60
Thermal Conductivity of Liquid at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0609	0.0492	0.0595
Thermal Conductivity of Liquid at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0680	0.0559	0.0704
Thermal Conductivity of Vapor at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0048	0.0056	0.0068
Thermal Conductivity of Vapor at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0045	0.0048	0.0060
Toxicity (Underwriters' Laboratories Group No.)	5	6	5A
Flammability & Explosivity	none	none	none
Relative Dielectric Strength of Vapor (compared with Ethyl Chloride as Unity)	3.00	2.40	1.31
Odor	Ethereal	Ethereal	Ethereal
Type of Compressor in Which Usually Used	Rotary & Centrifugal	Reciprocating & Rotary	Reciprocating
Evaporator Temperature Range	30 to 50°F	0 to 50°F	−130°F to 0°F
Solubility of Water in Liquid Refrigerant at 32°F (gm./100 gm. Refrigerant)	0.0036	0.0026	0.060
Solubility of Water in Liquid Refrigerant at 86°F (gm./100 gm. Refrigerant)	0.013	0.012	0.15
Oil Solubility (Miscibility with Lubricating Oils)	yes	yes	yes**

*Based on 5°F Evaporator Temperature and 86°F Condenser Temperature.
**Separates into two phases at lower temperatures.

FREE! VALUABLE NEW FOLDERS! Write today for important new informative folders, "Genetron" Super-Dry Refrigerants for Air Conditioning and "Genetron" Super-Dry Refrigerants for Refrigeration.

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Allied Chemical

Basic Chemicals for American Industry

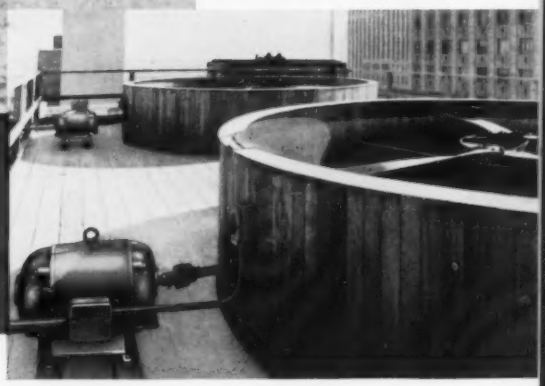
ROBBINS & MYERS AIR CONDITIONING MOTORS

For Cooling Towers
All R & M Air Conditioning Motors are completely "weatherized" for outdoor applications. Here is the one motor you can install and forget.

For Compressors
Patented R & M electronic speed-torque tester shows the *complete* acceleration curve of every R & M motor as it comes off the assembly line, enabling us to design out the dips that make a motor "hang up" and stall during starting.

For Blowers
R & M Air Conditioning Motors are balanced to a far greater degree than normal industry standards; won't transmit annoying vibration through metal ducts.

Robbins & Myers Has Done Something About the Weather!



When it comes to applications involving moisture—and lots of it—most motors just can't stand the gaff. And outdoor applications, like cooling towers, really put a motor to the test.

That's why you'll be interested to know about the unusual R & M "weatherized" Air Conditioning Motor. It's the one motor that's truly conditioned for air conditioning service—*at no extra cost to you.* Install it anywhere—even outdoors without a cover—and you'll see what this remarkable weatherizing process can mean in dependable, economical operation.

And there are other features—usually extra-cost optionals in most motors—that R & M brings you at standard motor prices. Extra-large prelubricated ball bearings . . . full-height end-heads with debris-proof screened openings . . . end-to-end clean-sweep ventilation.

These are just some of the things that give you the extra margin of dependability that air conditioning applications demand. Inside and out, R & M motors are engineered for every air conditioning job.

To get all the facts about the finest air conditioning motor your money can buy, write for a free copy of our Air Conditioning Motor Bulletin HP.

1 to 200 HP . . . Weatherized Inside and Out

Steel parts undercoated.

Rotor assembly rust-inhibited.

Cast-iron parts given special anti-corrosion treatment.

Terminal box gasketed, leads sealed at shell.

All standard R & M 220/440-volt motors easily reconnected on the job for 220-volt part winding starting.

R&M®

ROBBINS & MYERS, INC.

MOTOR DIVISION: SPRINGFIELD, OHIO • BRANTFORD, ONTARIO

Fractional & Integral h.p. Motors & Generators

Moyno Pumps

Propellair Industrial Ventilating Equipment

Electric Fans

Electric & Hand Hoists & Cranes

EQUIPMENT DEVELOPMENTS

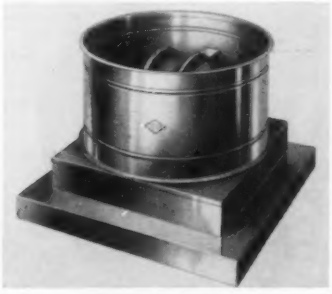
From p. 220

Air Conditioners . . .

. . . built to military specifications—Ellis and Watts Products, Inc., P. O. Box 33, Cincinnati 36. Designed for extreme conditions —65 to 130 F. Capacities range 3 to 13½ tons. Self contained. Air cooled condensers require no water.

A-C Welder . . .

. . . available with or without capacitors—Hobart Bros. Co., Troy, Ohio. Dual rated at 250 amp on 30 percent duty cycle, or 200 amp on 50 percent duty for single phase operation, 60 cycle, 230 volts. Current selected by twist of hand wheel and rheostat knob.



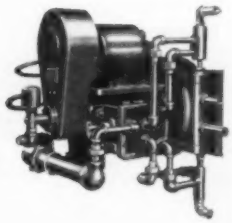
Power Roof Ventilating . . .

. . . for factories, office buildings, stores, apartments — Ilg Electric Ventilating Co., 2850 N. Pulaski Rd.,

SUPERIOR
combination GAS/OIL burners

Whatever the fuel . . . light or heavy oil, natural, manufactured, propane or butane gas . . . Superior Combination Burners will burn it Safely, Efficiently, Economically, and Automatically. Change-over from one fuel to the other is made in a matter of minutes without interruption of steam supply, and without disturbing or making any change in the equipment.

The Superior Gas Burner consists of a circular row of stainless steel nozzles set in a cast-iron gas manifold ring. The angle of the nozzles shapes the fire to the firebox. Combined with the Superior Oil Burner, the same fan supplies primary air for firing either gas or oil. For safety, a *constant* gas pilot guards every gas-firing cycle. For complete details write for catalog 2604.



Shown here is the other side of the SUPERIOR Rotary Burner with its 4-hole hinge, V-belt drive, dual pumps and reservoir.

for performance you can **BANK** on

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR ROTARY BURNERS

A CHALLENGE!

THE STRONGEST MADE BY ANY GALVANIZED SHEET:

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galvanized sheets

- Take all the ideal working qualities you have ever hoped for in a galvanized sheet . . . put them all together and you'll get some idea of the amazing workability of Wheeling SOFTITE Galvanized Sheets.

  Here is a soft, ductile sheet, with the tightest zinc coating yet produced . . . so tight, in fact, that you can use Wheeling SOFTITE to make anything you make of steel sheets.

  If *you've* been having difficulty using customary galvanized sheets, try Wheeling SOFTITE. So many users have acclaimed it the ideal galvanized sheet that Wheeling is tripling its SOFTITE production facilities in 1955.

  Get details today. Call or write the Wheeling sales office nearest you. Wheeling Steel Corporation, Wheeling, West Virginia.

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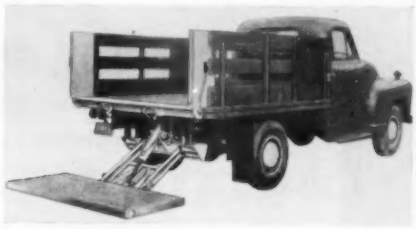
HOUSTON NEW YORK PHILADELPHIA ST. LOUIS SAN FRANCISCO WHEELING

EQUIPMENT DEVELOPMENTS

Continued

Chicago 41. Two new types: "RVS" for low air volume requirements in ventilating small areas. Features quiet operation. Used with or without ducting. Motor, connected to fan wheel, sealed from air stream. "SB," shown, has upblast design. For capacities to 37,600 cfm of air. Butterfly dampers open automatically when fan turned on.



Lift Gate . . .

. . . with 1000 lb capacity—Anthony Co., Streator, Ill. For loading, unloading equipment, materials. Designed for ¾ and 1 ton stake and van trucks, also mounts on larger trucks. Manual operation, spring closed. In ramp or square end general purpose styles.

Radiation . . .

. . . custom made to order for steam, hot water heating — Warren Webster & Co., Camden 5, N.J. "Custom Warren Walvector" uses window sill as part of heating enclosure. Eliminates need of separate sills, plastering. Heating element is copper tubing with aluminum fins, 3 or 4 in. For wall mounting or with integral sill; front or top outlet; for single or double row heating element.

Sleeve Casing . . .

. . . for built-in wall air conditioning unit—Tywel Mfg. Corp., 5702 First Ave., Brooklyn 19. Fits into wall opening of building under construction. Unit then fits into sleeve. Cover fits over unit making installation look like radiator grille. Is said to provide flush-to-wall installation, very little overhang outside.

Why

this Jam-Proof 65R

RIDGID

is most pipe threader for your money

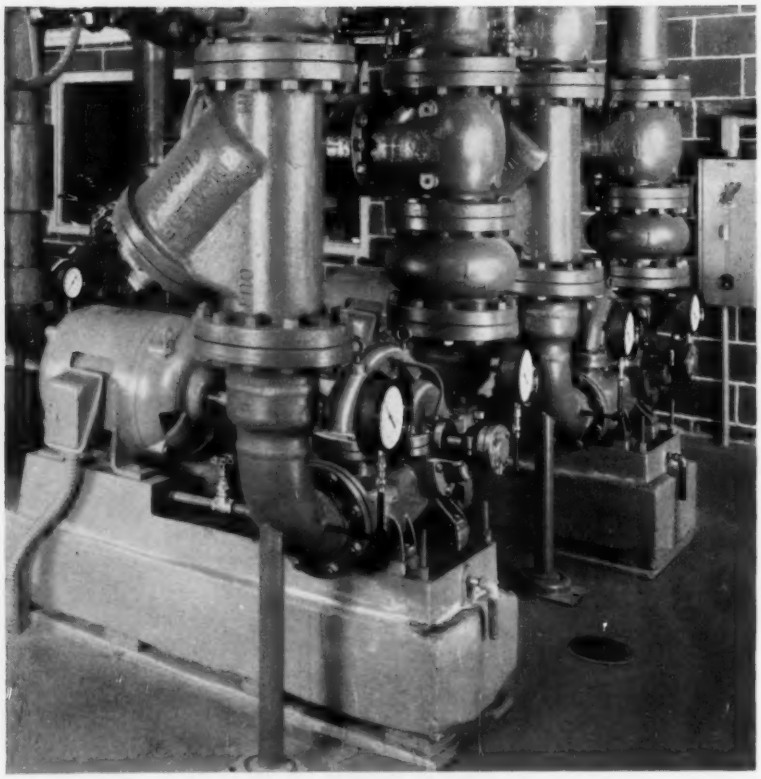
Easiest to Use... Threads 1", 1¼", 1½" and 2" pipe and conduit with 1 set of chasers that adjust to size in 10 seconds. Mistake-proof self-centering workholder sets instantly to size. Threader can't jam—it kicks out automatically when standard length thread is cut. Unbeatable speed, least work.

Perfect Threads... 65R cuts beautiful threads—and you find the factory test sample in your new die stock to prove it. No other threader gives you as much for your money.

Ask to see the 65R at your Supply House. Try it, buy it—it's a bargain in satisfaction.

The Ridge Tool Company, Elyria, Ohio, U.S.A.

RIDGID
Work-Saver Pipe Tools



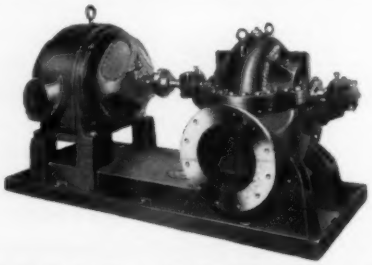
Will the PUMPS Match The Excellence Of Your Installation?

The wrong pump can spoil the most perfectly planned job — the right one helps make it a lasting success! "Buffalo" Pumps like the Double Suction Type SL below (for clear water service) have earned the reputation for reliable performance over and over. The "Buffalo" Q Factor — *the built-in Quality which provides trouble-free satisfaction and long life* — goes into every "Buffalo" Pump you specify.

WHY TAKE A CHANCE? PICK "Buffalo" THE PUMPS PROVEN BY 78 YEARS OF SATISFACTION.

YOUR "BUFFALO" REPRESENTATIVE

is ready with competent help in selecting the right pump for any problem you may have. Graduate Engineers, factory and field trained. In all principal cities. Call on your nearest one!



BUFFALO PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo" PUMPS

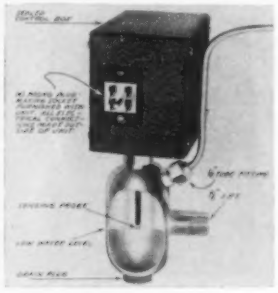
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

EQUIPMENT DEVELOPMENTS

Continued

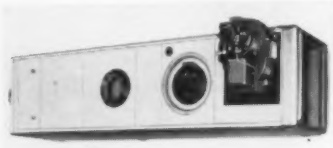
Belt Drive Ventilator . . .

. . . with lightweight aluminum design —Loren Cook Co., Depot St., Berea, Ohio. Sizes 1000 to 16,500 cfm. Motor sealed from air stream. Low silhouette. Designed for quiet operation. Wheel nonoverloading. Shell lifts off to clean base assembly.



Level Control . . .

. . . with floatless design, sealed control box for boiler pump control, cutoff, alarm—Techniflex Corp., Port Jervis, N. Y. Is adaptation of probe type units applied to industrial equipment. Operates at 110 volts, a-c. When water level falls below probe tip, control activates.



Horizontal Oil Furnace . . .

. . . for commercial, industrial heating — C. A. Olsen Mfg. Co., Elyria, Ohio. Has firing rate of 2 gph of oil. Rated at 224,000 Btu output at bonnet. Gun type, pressure atomizing, vortex action, oil burner. Forced air supplied by 12 in., ½ hp blower at 2800 cfm.

WATSON-STILLMAN FORGED STEEL FITTINGS FOR: *Safe, Tight Connections* in pressure piping

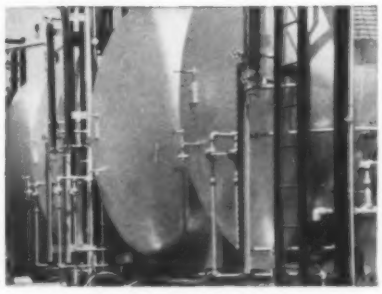
■ In high pressure steam lines... process liquid and gas piping... hydraulic fluid lines... wherever strong, tough pipe joints are needed, Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too... such as the heavy reinforcing bands extending well beyond the threads or sockets.

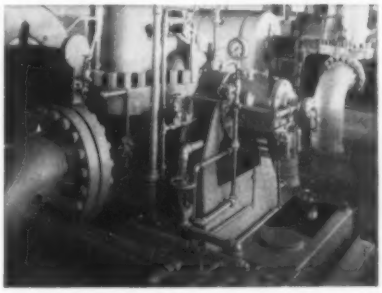
Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

Sold Through Leading Distributors



• *Process Liquid and Gas Piping*



• *High Pressure Lines*

WATSON-STILLMAN FITTINGS DIVISION
H. K. Porter Company, Inc.
Roselle, N. J.

14

USE PROPANE?

USE THIS TORCH-O-MATIC

USE ACETYLENE?

USE THIS TORCH-O-MATIC

Whichever Torch-o-matic you use —exclusive trigger-control saves you time, saves you fuel

With either the Propane or Acetylene Torch-o-matic, you get the *exclusive trigger-control* feature that saves time, saves gas, adds safety to every job.

The instant you pull the trigger, the flame lights, and you're ready to go to work. No matches, no adjusting, no time wasted. Release the trigger and the flame shuts off. And with the Propane Torch-o-matic, a special two-stage valve lets you increase the flame from a pinpoint to a full 6 inches in length simply by pulling the trigger completely back.

Add it up and you can quickly see how the AUTOMATIC ON-OFF trigger-control puts you ahead when you're using Torch-o-matic, saves you gas when you're not.

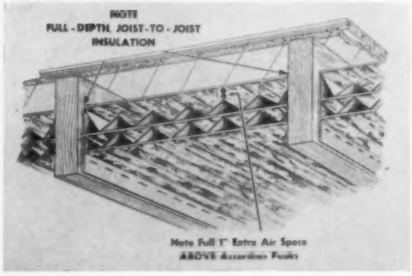
The Acetylene Torch-o-matic fits your present equipment, features a wide selection of nozzles for every job. The Propane Torch-o-matic connects directly to your propane tank—no intermediate valve fittings are necessary. Write for details.

VELOCITY POWER TOOL CO.

201 North Braddock Avenue
Pittsburgh 8, Pa.

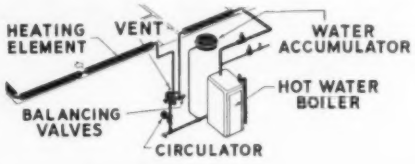
EQUIPMENT DEVELOPMENTS

Continued



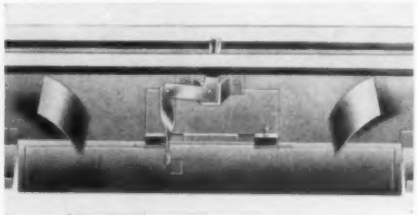
Thermal Insulation . . .

. . . with increased clearance above peaks of accordion fiber pleats designed to further reduce heat flow—Infra Insulation, Inc., 525 Broadway, New York 12. Added to three aluminum sheets, two accordion fibers reaching from joist to joist, with six reflective spaces including four inner reflective spaces. Is said to provide added insulation against convection, conduction. Made for 16, 24 in. centers.



Baseboard Heating . . .

. . . features "Hydro-Heat" water accumulator—Warren Webster & Co., Camden, N. J. Replaces ordinary expansion tank. Is designed to provide cushioning effect in eliminating water and air contact. System has purge header with single valve for use during initial filling, together with float operated positive vent.



Built-In Damper . . .

. . . for perimeter diffusers — Titus Mfg. Corp., Waterloo, Ia. Operates by lever control from center of top slot. Adjusts from full open to full closed easily. Has adjustable screw stop for special air volume requirements. No chains.

Neoprene Base Coating . . .

. . . for ducts, tanks, process equipment, pipes—Rubber & Plastics Compound Co., Inc., 30 Rockefeller Plaza, New York 20. "Nerva-Kote TNE" designed to provide corrosion-, water-, abrasion-, weather-resistant rubber film. Requires no priming, preparation.

No. 543, Standard Duty Fans
Class I and Class II
No. 544, Heavy Duty Industrial Fans
Class II and Class III
No. 545, General Purpose Fans
Portable Self-Contained Units
No. 546, Forward Curve Fans
Class I and Class II

nyb new BULLETINS

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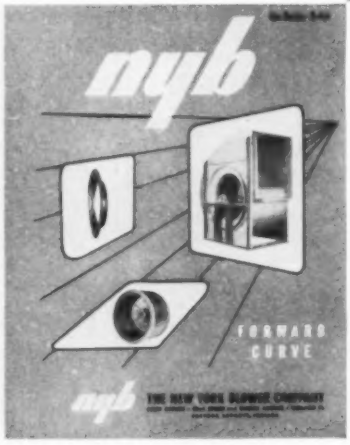
Write for your copies today.



A complete new series of centrifugal fans both forward curve and non-overloading (IPL), offering the latest in improved design, sturdy construction and quieter operation are now available.

Bulletins describing these fans with complete engineering data and capacity tables are now ready for distribution.

nyb THE NEW YORK BLOWER COMPANY
SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

DOERR Motors
solve problem
on Bush
Jet Coolers

Ceiling Jet Unit Coolers, a product of the Bush Manufacturing Company, of West Hartford, Connecticut, have the responsible job of maintaining continuous low temperatures in cold storage rooms. This calls for reliable motor operation, usually in the presence of high humidity.

The Doerr 1/10 hp, 1140 rpm, Type C, permanent split capacitor motor selected had to be suitable for replacement in existing units in the field. The band mounting used restricts the frame diameter and height is also at a premium. The unusual method shown for mounting the capacitor provided the answer and has simplified assembly in both production and in servicing.

This is another instance where Doerr has helped with a special design. If you have an unusual motor problem, please let us hear from you.

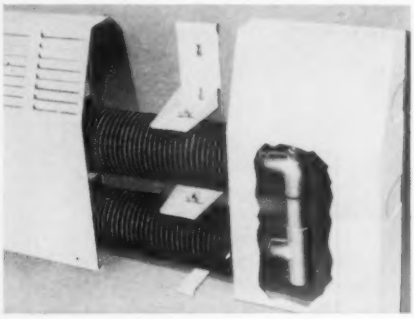
YOU GET MORE with DOERR!

DOERR
Electric Corporation
CEDARBURG, WISCONSIN

Electric Motors from 1/30 to 5 hp.
Standard or designed to your specifications.

EQUIPMENT DEVELOPMENTS

Continued

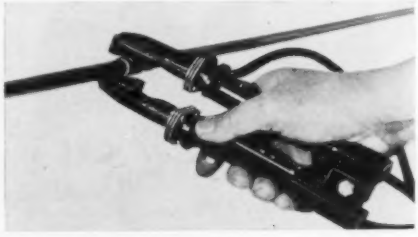


Convectors . . .

. . . for schools, auditoriums, factories, churches, hospitals—Convector Corp., 52 Canal St., S.W., Washington 24, D.C. With one to three tiers of copper tube heating elements with soldered aluminum spiral fins. Parts interchangeable for application as baseboard, wall hung or free standing convectors.

Indicating, Controlling . . .

. . . instrument for temperature, voltage, current, speed, other variables in process industries—Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill. "Panelmount Capacitrols" operate in harmony, but independently, to control process variable at two points. Feature plug-in unit construction.



Portable Soldering Set . . .

. . . is electric pliers with 1000 watt power unit — Wassco Electric Products Corp., Joliet, Ill. Cited features: no open flame, operates from nearest power outlet, eliminates gas supply problems. Primarily for soldering copper tubing "sweat" fittings to 1¼ in. Also works on electrical wire, cable. Pushbutton heat control.

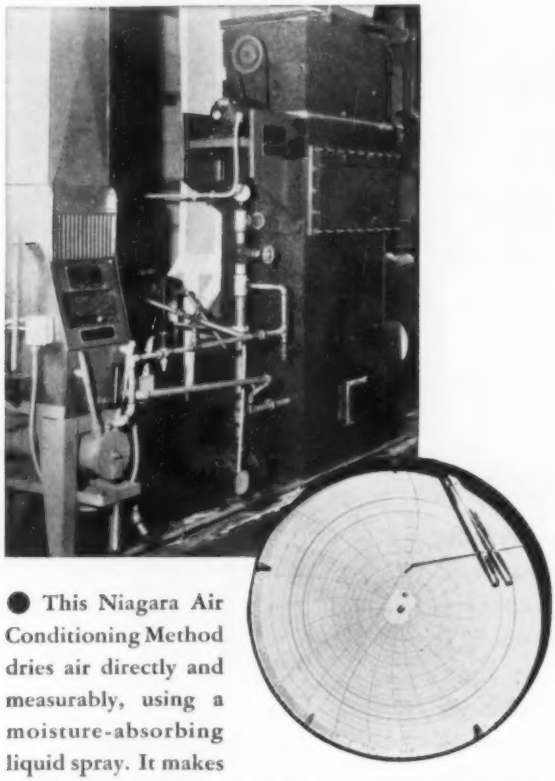
Air Conditioners . . .

. . . air cooled for where water is scarce, expensive—Thatcher Furnace Co., Garwood, N. J. Includes remote condensing unit. Installation flexibility suits unit for commercial applications where space is at premium. In three models: condenser units of 2, 3, 5 hp; cooling coils of 2, 3, 5 tons.

EXACT CONTROL

of Moisture Content

To Improve Your Product or Protect Your Materials or for Processes or Tests



● This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. It makes humidity control a separate function from lowering or raising temperatures and gives you precise control with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control installations have the best record for reliability.

Niagara Air Conditioning provides you with any temperature and relative humidity you need. Using "Hygrol" absorbent, it is not expensive to operate, saving the refrigeration commonly used to condense moisture and making re-heat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment. Ask for Descriptive Bulletins #112 and #121. Address Dept.— HP

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

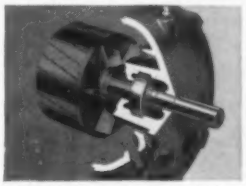
To AIR CONDITIONING ENGINEERS,

Howell suggests

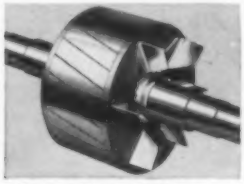
What to look for in Part-Winding Motors

If you've investigated reduced voltage starting of compressors, centrifugal pumps, etc. with part winding (synchronous) motors, you know of the economies and efficiency to be gained.* But, as in other types of motors, manufacturers' constructions differ considerably. Below are some points for comparison . . . and a few of many reasons why Howell motors are so outstanding!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!

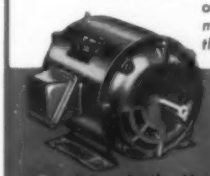


BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

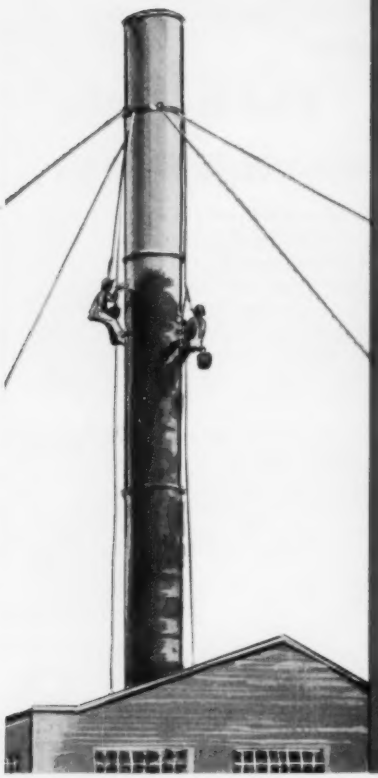
**Part winding motors reduce starting shock to machine, minimize line disturbances, and offer the advantages of low cost 2- or 3-step starters. A Howell motor specialist will be glad to show you their advantages (and limitations).*



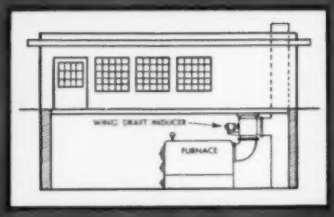
WRITE FOR BULLETIN PW-1

Precision-built Motors for Industry Since 1915

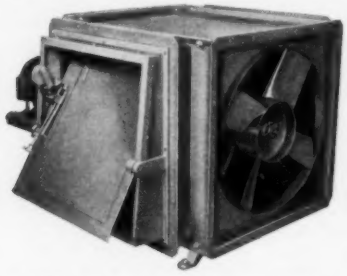
HOWELL MOTORS



The next time your stack needs painting or repairing... ...think of WING DRAFT INDUCERS



Natural draft is costly. Steel stacks require periodic painting; still they rust and corrode and need repair and replacement. Brick chimneys need periodic pointing. A Wing Inducer and an inexpensive stub stack to clear the roof, is all you need. And you get positive, adequate draft at all times, regardless of wind or weather. *Write today for bulletin. Use the coupon.*



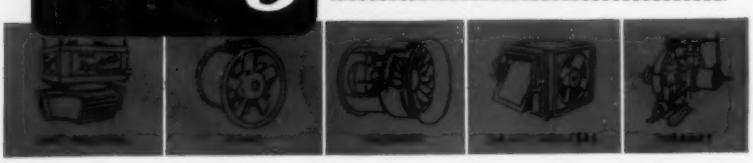
WING DRAFT INDUCER SHOWING AXIAL FLOW FAN AND BAROMETRIC DAMPER (Optional)

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N.J.

Factories: Linden, N. J. & Montreal, Canada

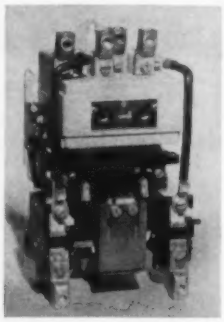
L. J. Wing Mfg. Co., Linden, N. J. HP-6
Please send me bulletin on WING DRAFT INDUCERS.
Name.....
Firm.....
Address.....
City..... Zone..... State.....

Wing



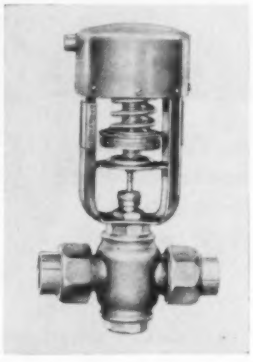
EQUIPMENT DEVELOPMENTS

Continued



Magnetic Starter . . .

. . . in NEMA size 4 for motors to 100 hp—General Electric Co., Schenectady 5. Vertical lift type. Strongbox coil design includes plastic case to protect coil windings. Permanent air gap causes starter to drop out when de-energized. In reversing, multispeed, combination forms. With vertical or horizontal mechanical interlocks.



Motor Valve . . .

. . .with bellows equipped all-metal design for hydraulic, pneumatic control systems — Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville. For flow control of steam, gas, oil, water, etc. Is final control element to maintain pressure, temperature or level in industrial vats, tanks, processes. Sizes ¼ to 4 in. in variety of types. Direct or reverse acting models.

Damper Opener . . .

. . .for power roof ventilators — Propellair Div., Robbins & Myers, Inc., Springfield, Ohio. Allows ventilator to serve as venting device for

NEED **STANDBY?**

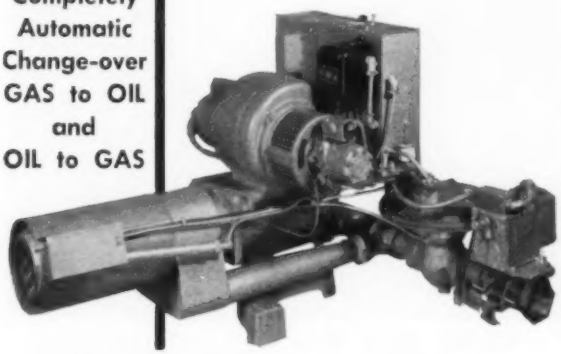
A **COMBINATION**

GAS OIL BURNER

WITH

AUTOMATIC CHANGE-OVER

Completely Automatic Change-over GAS to OIL and OIL to GAS



Roberts-Gordon has done it again!

A completely automatic combination gas-oil burner — in three sizes! Oil capacity . . . 2½ gal. to 30 gal. . . . and available with modulating gas input . . . and 2-stage oil input.

It's compact — completely assembled and factory wired . . . and furnished with plug-in electronic controls for simple servicing!

Other ROBERTS-GORDON Industrial and Commercial Burners for Complete Heating and Processing . . .

MULTURI (Multiple Venturi) Burners

NORDENSSON POWER Burners

Write or phone for literature and details . . .

GAS HEATING EQUIPMENT

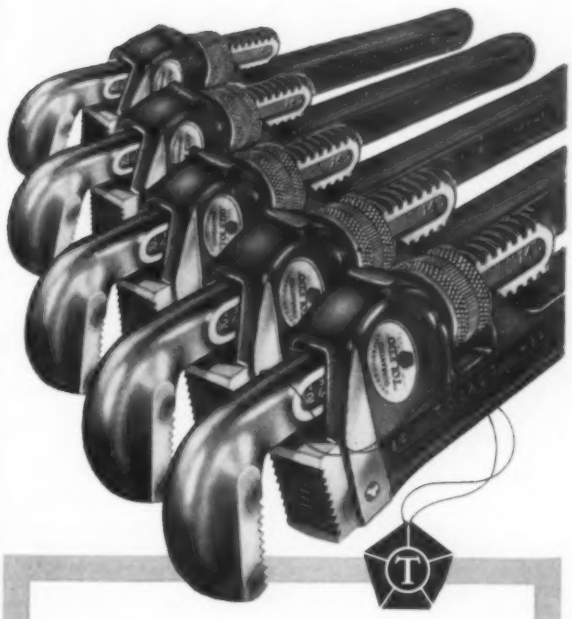
ROBERTS-GORDON

DEPT. HPAC BUFFALO 6, N. Y.

FURNACES BOILERS

UNIT HEATERS CONVERSION GAS BURNERS

ASK THE PIPE FITTER



there is a difference in pipe tools!

Good pipe tools mean longer service life and greater satisfaction on every job. Toledo unconditionally guarantees every pipe wrench it makes . . . your assurance of maximum service at lowest cost. Single spring action gives quicker, easier setting on pipe surfaces. Replaceable jaws in every size from 6″ to 48″. Your supplier knows and stocks Toledo pipe wrenches, pipe cutters, pipe threaders and power machines. Next time try Toledo.

THE TOLEDO PIPE THREADING MACHINE CO.

TOLEDO 4, OHIO

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

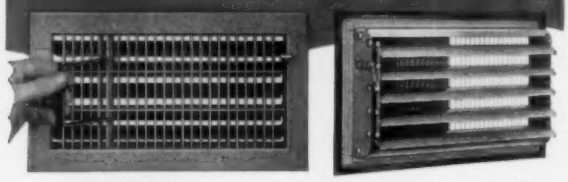
You can get

DIRECTED AIR FLOW

at any angle with

INDEPENDENT "Fabrikated" AIR CONDITIONING REGISTERS

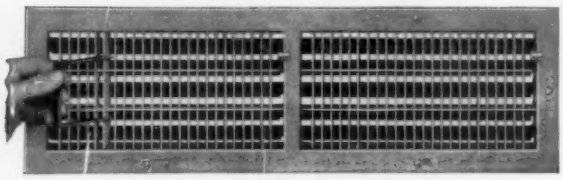
REG. U. S. PAT. OFFICE



321-A HMV

Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4″ to 48 x 24″, including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog No. 54.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

???

WHY...

???

Power Combi-Matic

Forced Draft **GAS OIL** **Burners**

Here are THREE IMPORTANT REASONS...

(and there are more)

FGO Series... GAS-OIL BURNER—6 models in capacity to 3,500,000 BTU input.

1. POWER combi-matic offers the most complete line and advanced design for light oils and gases.
2. Now! controlled combustion on both gas and oil... with higher efficiency and lower operating costs.
3. Positive and complete *safety* with a *pre-purge* period in standard operating cycle.

MORE SALES FOR YOU... BECAUSE THERE ARE MORE ADVANTAGES FOR YOUR CUSTOMERS:

- Factory "FIRE-TESTING" insures... "on the job" performance.
- Automatic air adjustment... lets you set it—forget it.
- Electronic safeguard... responds immediately to flame interruption.
- Pressure safety control... prevents opening of either fuel valve unless air for combustion is proven.
- Optional automatic or manual changeover...
- GAS ELECTRIC IGNITION... is automatic on BOTH fuels.

SOMETHING EVERY DEALER WANTS:

- Less installation time.
- Standard parts and controls always and immediately accessible...

Power combi-matic Gas-Oil burners are but one important part of a complete line of burners.

FG Series—Power gun type burners—ideal for all conversion applications... particularly oil burner replacement.

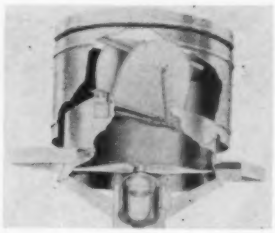
BFG Series—Heavy duty Power-Flame burners—large capacities for heating, power or processing.

A Power-Flame Dealership can be valuable; write today for complete information

Power-Flame BURNER

A Division of

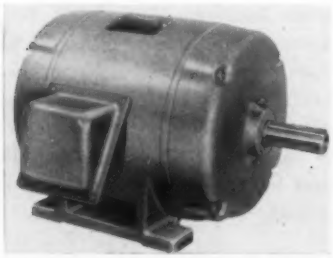
Siemon Manufacturing Company • Grandview, Mo.



smoke, heat, fumes in case of fire. Consists of twin steel springs mounted on telescoping steel tube support. Activates when critical temperature is reached. Two sizes for ventilators 24 to 60 in. diameter.

Cooling Tower . . .

. . . for small commercial use—Lilie-Hoffmann Cooling Towers, Inc., 1450 S. Vandeventer Ave., St. Louis. In 3, 5, 8, 10 ton units. Heavy gage steel construction. Coated with sound-deadening, rust-resistant mastic. Standard equipment includes air inlet screens, top distribution pan cover.



Polyphase Motors . . .

. . .with ball bearing design, NEMA frame sizes 182 to 326 — Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14. Cast iron frames for indoor or outdoor use. Moisture protected, drip-proof design. With 1 to 30 hp ratings, 3 phase, 60 cycles, 1750 rpm.

internal swivel action
gives you two-way control over movement of piping

With the Blaw-Knox functional spring hanger, you can readily control both lateral and longitudinal swing movements of hanger rod up to 7 degrees.

For the hanger is designed with the Blaw-Knox patented *internal swivel action*, which permits movement while the hanger case itself remains vertical. Larger movements are readily accommodated by overhead roller assemblies. Each is a complete packaged unit ready to install.

In fact, our entire line of rigid hanger assemblies, overhead roller assemblies, vibration eliminators, as well as the functional spring hangers and constant support spring hangers are furnished as complete units . . . thereby saving engineering time and eliminating expensive cutting, threading and assembling in the field.

Our engineers, who have had years of experience, are available to both design and make recommendations for your hanger requirements.

BLAW-KNOX COMPANY
Power Piping and Sprinkler Division
Pittsburgh 33, Pennsylvania

Send for your copy of Bulletin No. 54 to get complete information

BLAW-KNOX **PIPE HANGERS**

Complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated piping systems for all pressures and temperatures

"Janitrol heaters are the most satisfactory for us. Maintenance is no problem at all"

O. W. WHEELER, Maintenance Supervisor, Garland-Temco Plant.

GARLAND, TEXAS BRANCH PLANT

TEMCO AIRCRAFT CORPORATION

Starting in 1946 with 100 Janitrol installations, Temco Aircraft Corporation added 43 more in 1951-52 . . . 6 in 1953 to keep pace with the Garland Branch plant expansion program. Their repeat installations over an eight year period clearly indicate complete satisfaction with Janitrol quality, dependability and low operating costs.

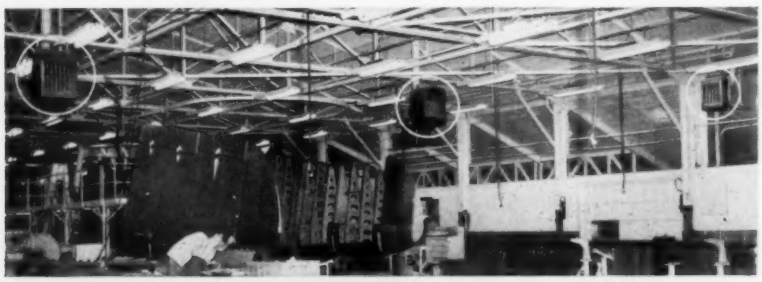
Whether your heating needs can be met with one unit heater or 100, it's important to you that an experienced, local Janitrol contractor size and install the right equipment.

This way, you get triple assurance of efficient and economical heating. You get equipment with unequalled performance record* . . . equipment that's properly installed . . . and backed by a responsible engineering and service organization.

Local Janitrol gas heating engineer-installers are listed under "Unit Heaters", yellow pages, your phone book.

Mr. Wheeler checks in shipment of Janitrol gas-fired units, installed as part of Temco-Garland's 1953 expansion program.

* With over a million steel heat exchanger tubes installed since 1940, less than ¼ of 1 % have been replaced for any cause.



149 JANITROL INSTALLATIONS SINCE 1946 PROVIDE EXCELLENT WORKING CONDITIONS AT LOW OPERATING COST

Janitrol GAS-FIRED UNIT HEATERS

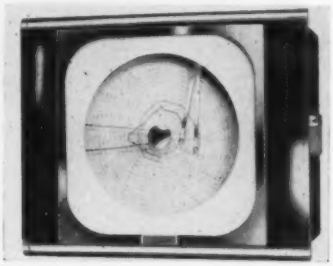
Write today for information on unit heaters for new or remodeled buildings of all types. Ask for "Businessmen's Blue Book of Better Heating".

Janitrol Heating & Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio
In Canada: Alvar Simpson Ltd.
Toronto 13

ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES AND *Kathabar* HUMIDITY CONDITIONING

EQUIPMENT DEVELOPMENTS

Continued



Recorder . . .

. . . with two pens to make two continuous records at same time on 12 in. round chart—Bristol Co., Waterbury 20, Conn. Designed for use in applications where records of two related measurements must be compared. Cited uses: comparing wet and dry bulb temperatures, Btu and temperature, rotation speeds from two different points.

Cutting Machine . . .

. . . for metal working plants, contractors — Beaver Pipe Tools, Inc., Warren, Ohio. Designed to cut all shapes, types of materials. In two types: No. 20 has foot controlled chain vise to hold material. No. 14 has hand operated chain vise. Machines feature sealed, double row ball bearings.

A-C Motor . . .

. . . with corrosionproof design — Reliance Electric & Engineering Co., 1058 Ivanhoe Rd., Cleveland 10. New metering plate meters grease flow to the bearing, limits grease pressure against bearing. Other cited features: adaptation to established lubrication schedules; balanced rotors annealed for magnetic efficiency; solid cast

Dry air saves $40,000

The Haloid Company, Rochester, N. Y., saves $40,000 a year by using Kathabar humidity conditioning equipment for drying photographic paper at low temperatures. Chemical dehumidification supplies air free of damaging moisture to the Haloid drying tunnel. This permits refrigeration to handle the sensible cooling load economically.

Haloid had previously dried the air for their tunnel dryer by over-cooling, then re-heating to required temperature. But now, with Kathabar equipment supplying air to the drying tunnels, they have eliminated tons of cooling, reheating costs, and frost. Haloid engineers estimate the total annual saving at $40,000.

Other film makers have found similar savings by using dry air in chilling and casting rooms.

Equally dramatic stories are repeated in many other applications of Kathabar equipment to low temperature drying. It will pay you to check the superiorities of Kathabar humidity conditioning.

write for the complete Haloid-Kathabar story today

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

BARBER COLMAN

New Wheelco Combustion Safeguards

A totally new standard in combustion safeguards for all fuels!

For all types of commercial and industrial heating equipment . . . whether gas- or oil-fired . . . the *all-new* Wheelco Flame-otrol gives you a new measure of protection against flame failure hazards, plus wider selection of detection systems for maximum design flexibility, ease of installation, and freedom in choice *and use* of burners, pilots, and fuels.

Manual or *automatic* models give you total burner and fuel shutdown, plus true "safe-start" operation, with automatic delay for the safe-start circuit!

Phone your nearby Wheelco Representative for help in designing and installing a properly integrated *electronic* combustion safeguard system for single- or multiple-burner applications.

Write for complete facts

Helps you specify . . . gives you information on six outstanding design features of the *all-new* Wheelco Flame-otrols . . . describes exclusive user-benefits never before offered in a low-cost instrument. Write for Bulletin F-6570, *today!*

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

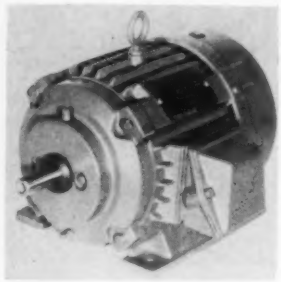
Dept. R, 1507 Rock St., Rockford, Illinois

BARBER-COLMAN OF CANADA, LTD., DEPT. P, TORONTO, ONTARIO, CANADA

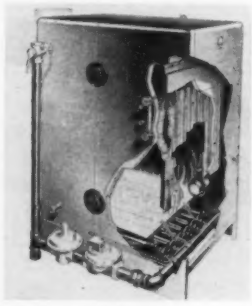
Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Small Motors
Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

EQUIPMENT DEVELOPMENTS

Continued



iron frames; special insulation process designed for impregnation against acids, moisture, oils.



Gas Fired Boilers . . .

. . . so constructed that steel jackets can be assembeld *after* piping is installed — American Radiator & Standard Sanitary Corp., P.O. Box 1126, Pittsburgh 30. In two models: "G-6," for larger industrial or commercial use, has 650,000 to 5,200,000 Btu per hr input capacity. "G-4," for smaller use, has 180,000 to 600,000 range.

Duct Heaters . . .

. . . in five capacities, oil fired—Delta Heating Corp., Trenton, N. J. For use with remote operated air cooling unit. Inlet, outlet sides flanged for air duct attachment. Largest size has 200,000 Btu per hr output, smallest 112,000.

BARBER COLMAN

ELECTRIC-ELECTRONIC

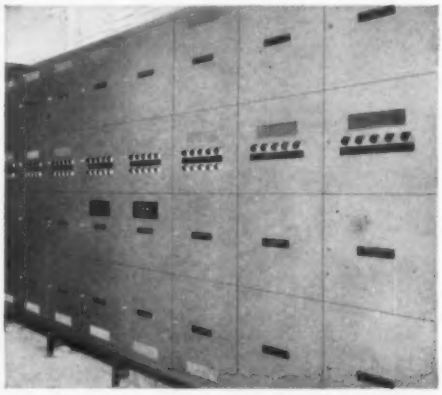
Control Centers

In Milwaukee, Wisconsin Telephone Company engineers specify better control . . . electrically

Electric-electronic controls have been specified again by telephone engineers . . . this time in Milwaukee for the new and existing Headquarters buildings of the Wisconsin Telephone Company. Electric-electronic controls are used throughout the new six-story addition (foreground), completed late in 1954. Modernization of the nineteen-story older building is in process — electric-electronic controls have been installed on eight floors to date. The speed, flexibility, accuracy, and reliability of electrical equipment were big factors in the selection, plus savings on original cost of the controls, installing labor and materials, and maintenance.

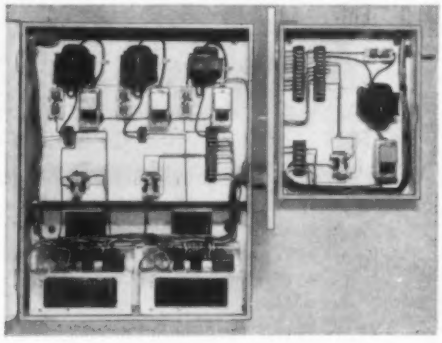
Architects (both buildings): GRASSOLD-JOHNSON & ASSOCIATES. *Consulting Engineer* (new building): JOSEPH VOLK, deceased. *Consulting Engineers* (remodeling old building): LOFTE & FREDERICKSEN. *Heating Contractors* (both buildings): PAUL J. GRUNAU CO. *Ventilating Contractors* (both buildings): REINKE & SCHOMANN, INC.

In new addition, all radiators, convectors, and reheat coils are individually controlled with electronic outdoor reset on the hot water supply. Remodeled building has Barber-Colman controls for ventilation, reheating coils, and direct radiation.

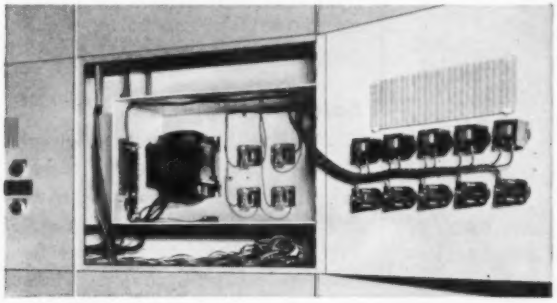


Modern "Control Center" (above) in remodeled building serves as central junction box, houses prewired accessories, numbered terminal strips, indicating lights, remote starting buttons, etc. A Uni-Flo "VF" Grille provides ventilation of each compartment.

Another "Control Center" (below) in new building serves as "nerve center" to speed field installation, expedite checking, simplify revisions and servicing. It's the fast, cost-saving method for modern buildings.



(Below) **One of twenty-four** compartments comprising the 8' x 16' "Control Center" in remodeled building. This type of installation exemplifies latest cost-saving techniques in automatic control system engineering.



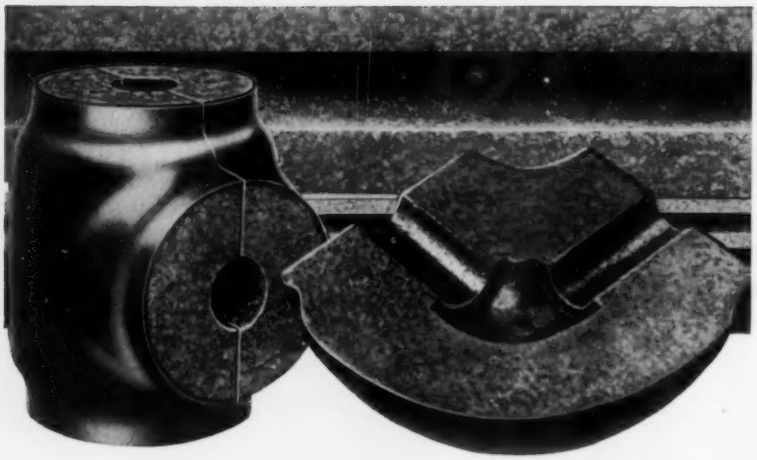
Rapid response of electronic controls appealed particularly to the telephone engineers. Controls for the lobby compensate instantaneously for heat loss through front doors. Controls on fresh air supply adjust mixture continuously for improved comfort conditions. "Better control . . . electrically" is now practicable for most installations in large or small buildings. Phone your nearby Field Office, or write us for data, prices, and expert engineering service on any automatic control problem.

Barber-Colman Company

DEPT. R, 1301 ROCK ST., ROCKFORD, ILLINOIS, U. S. A.

Field Offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery



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Light Duty Thickness (Ice Water)	to 30° F
Medium Duty Thickness (Brine and Ammonia)	to 0° F
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For all standard pipe sizes and fittings. Molded of compressed pure granulated cork, finished with moisture-proof mineral mastic.

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United Cork Companies have expanded their facilities to include the production of cork pipe covering. Increased quantities of most frequently used sizes are now available at key points coast to coast . . . in either distributor or branch warehouse stocks . . . thus insuring fast delivery of your installation requirements.

CORK. . . STILL UNSURPASSED AS A COLD LINE INSULATOR

- Extremely low thermal conductivity
- Saves at least 80% of refrigeration lost from bare piping
- Easily economically applied
- Permanent and durable, lowest long-term cost
- Does not support combustion
- Neat, sanitary, vermin-proof
- Has no capillarity

YOUR INQUIRY will bring you specifications, helpful installation data, descriptive material on United's cork pipe covering . . . and patented BB (block-baked) 100% Corkboard specially processed for low temperature work. No obligation.

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UNITED CORK COMPANIES

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Manufacturers of cork insulation for almost a half century

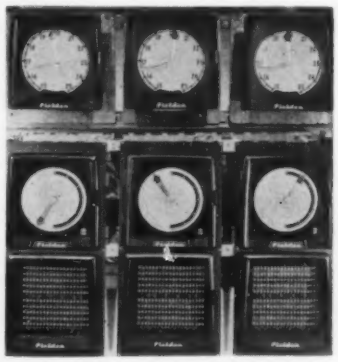
Engineering offices, or approved distributors, in key cities — coast to coast.

EQUIPMENT DEVELOPMENTS

Continued

Sweat Type Gate Valve . . .

. . . for copper tube jobs—Milwaukee Valve Co., 2375 S. Burrell St., Milwaukee 7. Model 1145 is solder type for working pressures 125 lb. steam, 200 lb. W.O.G.; sizes ⅜, ½, ¾, 1, 1½, 1¼, 2 in. Features nonrising stem, solid wedge disc construction, uniform outlets. For industrial plumbing, heating systems.



Indicating Scanner . . .

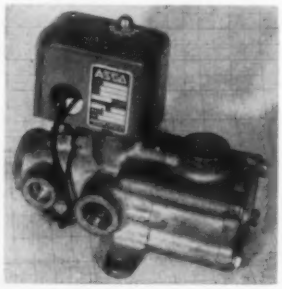
. . . tests, controls industrial processes from single vantage point—Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33. Designed to monitor process variables involving level, temperature, thickness, mechanical movements, tolerances, weight, pressure. Will check 6, 12, 24, 48 and more steps in manufacturing process, says company.

Solenoid Valve . . .

. . . designed to eliminate piston malfunction due to binding, residual magnetism—Automatic Switch Co., 391 Lakeside Ave., Orange, N. J. Poppet type. Said to provide safety, cut down leakage. Cycling rates to 850

EQUIPMENT DEVELOPMENTS

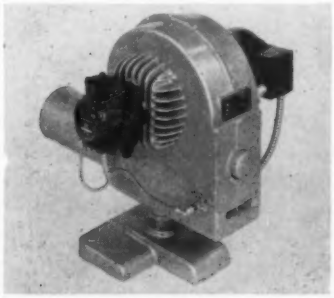
Continued



per min. Power operated in both directions. Spring action eliminated. In single, dual solenoid models.

Air Conditioners . . .

. . . for restaurants, banks, schools, hotels, hospitals, etc. — American Blower Corp., Detroit 32. Self contained units in 3, 5, 7½, 10, 15 ton sizes. Discharge plenums shorter than comparable units, made possible by cold flow diffuser grille sections with curved blades. Units can be provided with steam, hot water coils.



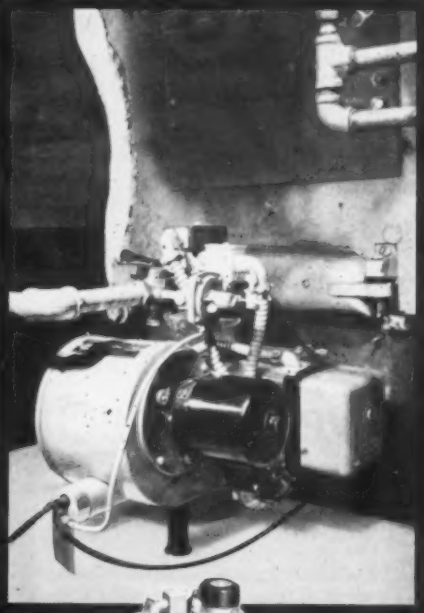
Oil Burners . . .

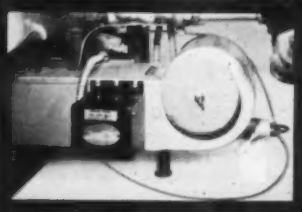
. . . in three models with firing ranges 3 to 20 gph—Nu-Way Corp., Rock Island, Ill. Feature twin nozzles, two stage pump, delayed action valve. Larger capacity units have dual ignition systems with independent trans-

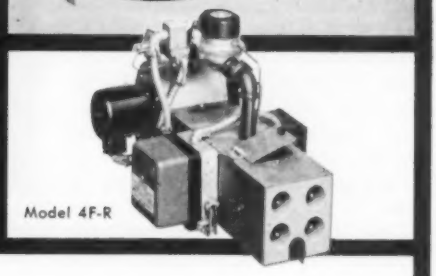
Choose Mettler FAN-AIR "small conversion" Gas Burner for volume water heating

with these standout features:

- Burns all gases at low pressures in any heat exchanger, with all combustion air from a low speed fan, or limited operation with natural draft.
- Has exclusive Mettler spark-ignited, rectifier safety pilot and dependable full-flame safety protection.
- Capacity range easily adjustable from 100,000 to 600,000 Btu.







Model 4F-R

● This Mettler "Model 4F-R" Gas Burner . . . recently installed for volume water heating in a large Santa Barbara estate . . . offers many stand-out features for conversion of small boilers and furnaces. For, its replaceable jets permit easy, low-cost adjustment of input within an extremely wide range. Highest possible efficiency is achieved, too, because gas and air are thoroughly mixed by converging streams in each of the four burner ports. It's a quiet, clean-firing unit, and gives you *uniform* heat distribution impossible to match with any other burner. So, if you're looking for a low-cost conversion burner with *big-burner quality* . . . a packaged unit, complete with all controls for fully automatic firing and highest safety factor . . . *specify* Mettler's Model 4F-R, FAN-AIR! Write for Bulletin G-100.

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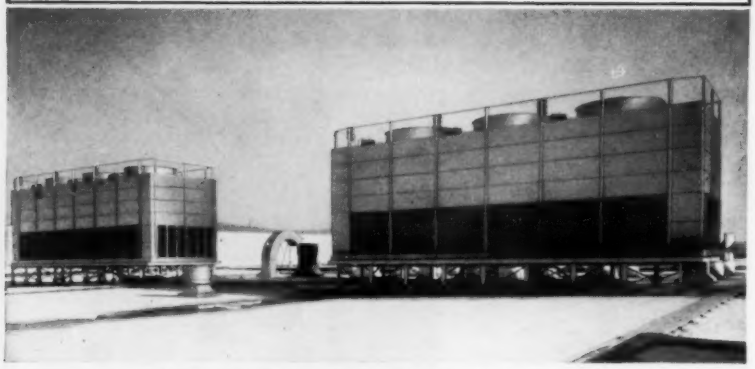
4366 Worth Street, Los Angeles 63, California

BINKS cooling systems

COOLING TOWER NEWS



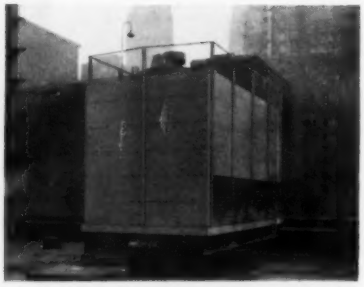
These two Binks Cooling Towers cool water for industrial processing (see text)

Each of these cooling towers solves a specific problem . . .

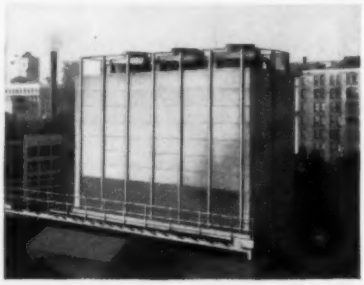
The two towers illustrated above are on the roof of a large industrial plant. The one on the right cools 4000 gals. of quench water per minute. The other cools 2850 gals. of water a minute for electrical heat treating equipment. The air intakes on this tower are equipped with filters to trap all dirt and dust and to keep the cooling water clean.

The towers shown to the right are used in the air conditioning systems of two large commercial buildings. The one tower had no space restrictions, the other was very limited...But Binks Engineers met both conditions with a tower that assures excellent cooling, long trouble-free service and definite economies.

Engineering help available Binks manufactures cooling towers of all types and capacities ranging from small residential-types of 3 gpm to giant towers of 15,000 gpm. To help you get the right tower a Binks Engineer will study your needs and submit proposals without obligation. For full details write to:



This tower serves a large Chicago store using 500 tons of refrigeration



On top of a tall office building using 535 tons of air conditioning

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A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

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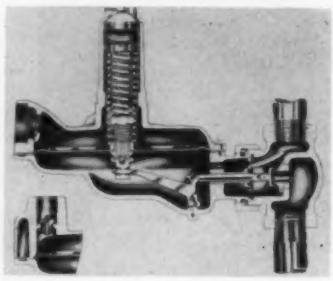
EQUIPMENT DEVELOPMENTS
Continued

formers, electronic primary mounted relays, adjustable floor mountings.



Gas Service Regulator . . .

. . .with 360 deg swivel type design — Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8. Can be mounted in most any position when equipped with four positional side drain cover. Models for regular or high pressure services. High pressure model offers maximum 10 psi outlet pressure range.

Equipment Briefs . . .

AUTOMATIC RESET TIMER with dial setting for timing, sequencing electrical load circuits on industrial machinery, process operations — Automatic Temperature Control Co., 5200 Pulaski Ave., Philadelphia 44. Applications cited for "Atcotrol": chemical feed proportioning, exhaust fans, motor starting, water treatment, pump control, temperature programming. Contacts rated at 10 amp at 115 volts, a-c noninductive.

RETURN AIR GRILLE for perimeter baseboard installations — Air Control Products, Inc., Coopersville, Mich. Designed for installation with company's baseboard perimeter diffuser. In 4 ft sections. Requires no stackhead. Bottom of unit has knock out sections for duct installation.

CONTROL for remote operation of dampers, vents, valves — Arens Controls, Inc., 2017 Greenleaf St., Evanston, Ill. Will produce 1½ in. linear push-pull motion by turning knob

EQUIPMENT DEVELOPMENTS

Continued

270 deg. Requires one nut for mounting. Plated steel construction.

THREAD COMPOUND for stainless steel, high temperatures to 1800 F — Felt Products Mfg. Co., 1504 Carroll Ave., Chicago 7, "Fel-Pro C-5" formulated on colloidal copper base in nonvolatile, viscous carrier. Designed to "copper plate" metal to prevent direct contact.

PRESSURE CONTROL utilizes evacuated bellows, is designed to provide positive switching action in response to source pressure variations independent of atmospheric pressures, temperatures — United Electric Controls Co., 85 School St., Watertown 72, Mass. With spring loaded bellows. Expansion, contraction of bellows actuates switch.

AIR CONDITIONED TEST CABINET designed for control of relative humidity, temperature for testing materials, products, specimens — Niagara Blower Co., 405 Lexington Ave., New York 17. Saturates air at required dew point temperature and reheats to desired dry bulb temperature. Controls RH 5 to 95 percent. Temperature range: 150 F to −30 F dew point.

PRIMING PAINT for weather protection for galvanized iron, sheet zinc—Tropical Paint Co., 1244-82 W. 70th St., Cleveland 2. "Zincoater" recommended by company for ductwork, water tanks, towers.

CLAMP for plastic pipe, other applications where corrosion-resistance essential—Ideal Corp., Brooklyn 7. Entirely of stainless steel. Inter-locked construction requires no rivets, spot welds.

ARC WELDING SYSTEM for welding chromium-molybdenum alloy steels in high temperature, high pressure piping—Metal & Thermit Corp.,

MECHANICAL SEAL permanently seals against shaft leakage. *No expensive time or material required to service these pumps.*

FRAME BEARINGS ARE GREASED FOR LIFE and *positively sealed against dirt and water.*

Trouble-free and maintenance-free, CARVER PUMPS are "*Your Best Buy for Better Performance.*"

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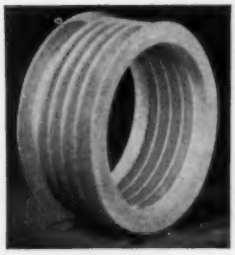
Rubber Expansion Joint

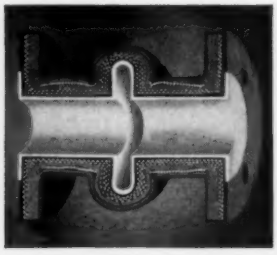
Rectangular-type
Rubber Expansion Joint

U-type
Rubber Expansion Joint

There's a GARLOCK EXPANSION JOINT for your piping applications



All-Teflon* Expansion Joint



Rubber Expansion Joint with Teflon liner

Expansion Joint for use on Haveg and Duriron piping

- **To stop vibration, flange breakage**
- **To relieve stresses and strains in piping and equipment**

Garlock manufactures a *complete* line of expansion joints specifically designed to meet the requirements of different types of service. **Rubber Expansion Joints** are made in all pipe sizes from ¾" to 72" for water, air, or exhaust steam. They are furnished in round, rectangular, tapered or offset; spool-type and U-type.

All "Teflon" Joints or **Rubber Joints with Teflon liner** are made for chemical service; **Neoprene Joints** for oil service. Specially designed Rubber Expansion Joints are now available for use on piping and flanges made by **Haveg Corp.** and **The Duriron Co., Inc.**

Write today for Expansion Joint Folder AD-137.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

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PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS

EQUIPMENT DEVELOPMENTS

Continued

100 E. 42nd St., New York 17. Uses series of electrodes for particular welding requirements.

HEATING CABLES with polyvinyl chloride insulation with nylon jacket to eliminate "cable shadow"—Sunwarm, Inc., Kingsport, Tenn. Is said to have greater durability, toughness.

PLASTIC PACKING of "Teflon" for centrifugal applications—Flexrock Co., Packing Div., 3603-K Filbert St., Philadelphia 1. Serviceable from −150 to 550 F, says company. Cited applications: valves, pumps, agitators.

DIAL THERMOMETERS designed for easy readability—Precision Thermometer and Instrument Co., 1434 Brandywine St., Philadelphia 30. Black-on-white or white-on-black dial faces, 4 in. diameter.

MOTOR CONTROLLER RELAY for standard arrangements of contact combinations—Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 12. Operates at 115 volts, 60 cycles. Contacts rated 115 volts, a-c, 60 cycles, single phase, ½ hp.

PRESSURE PILOT with self contained design — Hammel-Dahl Co., 175 Post Rd., Providence 5. Has integral gage for process pressure indication. Provides direct setting of control point on same calibrated gage dial. Output pressure to 30 psi, positive valve action.

THERMOCOUPLE, TEMPERATURE TESTER combination designed for checking millivolt output of thermocouples from 0 to 50 and 0 to 1000, temperatures from "room" to 650 F—Robertshaw Thermostat Div., Robertshaw-Fulton Controls Co., Youngwood, Pa. Designed to automatically compensate for changes in ambient temperature. Unit contained in carrying case.

EQUIPMENT DEVELOPMENTS

Continued

MOTOR REDUCER for centrifugals, fans, hoists, etc.—Reuland Electric Co., Alhambra, Calif. Slip ring "Motoreducer" provides variable speed reduction, high starting torque on low starting current, says company. In ratings ½ to 5 hp, speed reductions 520 to 16 rpm.

RANGE INDICATOR to check output of linear variable differential transformers—Schaevitz Engineering, Camden 1, N.J. Designed to give quick, accurate indication of pressure, temperature, force, displacement.

DRAFT REGULATORS for 5 to 10 in. smoke pipe—Wm. Steinen Mfg. Co., 43 Bruen St., Newark 5. Calibration device sets back weight when front weight adjusted to proper setting on draft scale. Bearing bracket rotates around stationary hinge pin.

HERMETIC TERMINAL for electrical applications where hermetic seal essential—Lundey Assoc., 694 Main St., Waltham, Mass. Especially adaptable for sealed units in air conditioning, chemical processing, refrigeration, says company.

VINYL PROTECTIVE COATING provides 10 mil coating in single double-pass spray — Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif. Applied with conventional spray equipment. Is said not to flow away from edges, sharp corners.

PROGRAM, CYCLE CONTROLLER combined in two case unit — Bristol Co., Waterbury 20, Conn. For environmental test cabinets, process control.

AIR, HYDRAULIC BOOSTER CYLINDER designed for fluid pressure to 1951 psi using 100 psi input pressure — Airmatic Valve, Inc., 7317 Associate Ave., Cleveland 9. Is said to develop ratio of 19.7.

best on the job...

United Copper Tubing!

UDD V-Type Sealed End Assuring Moisture Free, Clean, Bright Surface

The new V-type sealed ends on UDD Copper Tubing are just one of many superior factors which have made this product a leading industrial choice in production operations all across the country. UDD Copper Tubing comes packed in drums with sizes plainly marked for easy use. Ask for New UDD Copper Tubing Folder.

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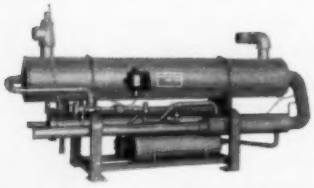
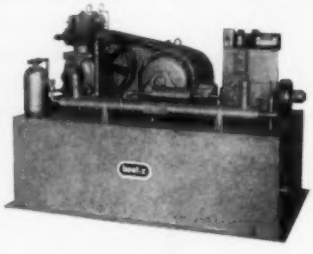
Heat-X 'PC' Units (above) provide the practical, space-saving answer to your water chilling needs . . . for air conditioning systems . . . drinking water or processing applications.

Inner-Fin construction of refrigerant passages, exclusive with Heat-X, permits a compactness impossible with old fashioned construction. Result: greater cooling capacity with far less bulk. Entirely self-contained, these **package** chillers are delivered completely wired, charged with Freon-12, ready to install. Only power and water connections are required. Available in 2 H.P. through 75 H.P. models.



'CCP' UNITS (right) are complete and ready to install, offer another method of packaged cooling. Combinations of cast aluminum coolers provide continuous chilled water, eliminate danger of freeze-up damage. Hermetic compressors carry 5 year warranty.

'PCL' UNITS (left) are designed for those who prefer a chiller to which they can tie in their own condensing unit and water pump. Construction is the same as the 'PC' line.



HEAT-X, Inc.
BREWSTER • NEW YORK

EQUIPMENT DEVELOPMENTS
Continued

PLASTIC LEAD SEAL polyvinyl tube for applying compound to threaded connections — Crane Packing Co., 1800 Cuyler Ave., Chicago 13. Tube is said not to crack, to withstand constant squeezing. Compound designed for pressures to 6000 psi, temperatures to 600 F.

PRESSURE INDICATOR with range of 0.1 to 20 mm Hg, expanded scale 0.5 to 5 mm — Hastings Instrument Co., Inc., Hampton, Va. Operates on 115 volts a-c. With ⅛ in. IPS male thread coupling. Can be used with one knob switching unit, allowing single operator to monitor multiple points from one indicator.

THREAD SEALING COMPOUND for pipes carrying volatile acids, alkalies, solvents — Gilbreth Co., 1211 Chestnut St., Philadelphia 7. Made of "Teflon." Chemically, biologically inert. For — 150 to 500 F. Requires no cementing.

STAIRWALKING HAND TRUCK walks up stairs carrying 350 lb when handles pumped up and down — L-S Heating & Engineering Co., 900 W. Lycoming St., Philadelphia 40. Magnesium construction. Has optional lifter for window air conditioners so one man can deliver, install without help.

PENETRANT for loosening corroded nuts, bolts, larger seized parts of equipment — Olin Mathieson Chemical Corp., 10 Light St., Baltimore 3. Nonoily, nonflammable, odorless. In half pint, pint, gallon, 5 gal containers.

THREADED STEEL RODS for industrial, contractor use — Redi-Bolt, Inc., East Chicago, Ind. Can be cut to length needed, used with standard nuts. Can be heated and shaped. In 13 diameters from 3/16 to 1½ in., 24 and 36 in. lengths.

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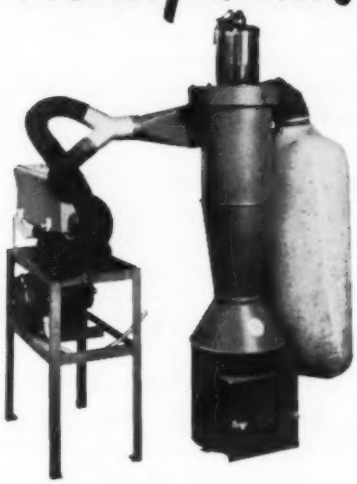
DUST COLLECTORS

Really draw!



A size and model to solve any dust collecting problem, Torit collectors provide complete, all-around dust control. Torit collectors are unitized for custom installation on each machine, giving power and suction only when machine is operating. Keeps plant and machines free from clogging and unsightly dust. Furthermore, cleaned and filtered air is exhausted back *into* the room maintaining heat balance. Find out now how Torit unitized dust control is engineered to your problems.

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AIR CONDITIONING PUMPS
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Check your cost against any other top quality air conditioning pump—size for size. You make big savings with Sta-Rite discounts.

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Check TDH and efficiency, too. You get top hydraulic performance . . . more water with less power.

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This pump is smaller, lighter in weight. Discharge outlet rotates to any of 4 positions. Mounting foot also rotates. Pump mounts at any angle for easy coupling and alignment.

Compare LONG LIFE

This trouble-free pump is constructed of top-quality materials, custom-engineered to assure long, dependable service. It eliminates service call backs, lets you keep your profits.

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If you need small, lightweight pumps to fit modern, compact air conditioning equipment, check Sta-Rite. You can see pump superiority in the all-bronze closed impeller. And special 2-piece impeller construction assures friction-free channels, more capacity. Motors are full power, ball-bearing and capacitor-type, specially designed and made only for Sta-Rite pumps. Mechanical seal is positive, leak-proof. Single shaft is corrosion-resistant, requires no coupling, prevents alignment problems.

Ask your wholesaler, or write for his name and a copy of new bulletin describing Sta-Rite Air Conditioning Pumps.

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RECENT TRADE LITERATURE...

▸ *ABSORPTION REFRIGERATING MACHINES*—Machines designed to produce large capacity cooling from steam, have no moving parts, use plain water as refrigerant, described in new 36 page catalog. Have cooling capacities 100 tons and up, says company. Carrier Corp., Syracuse.

▸ *AIR CONDITIONING*—Advantages of installing year 'round air conditioning in churches presented in case history form in new 6 page pamphlet. Carrier Corp., Syracuse.

▸ *AIR COMPRESSORS*—Bulletin No. 520-A comprises handbook designed to help compressed air users improve capacity of their installations. Features cooling controls for compressor jackets, aftercoolers, intercoolers. Sarco Co., Inc., Empire State Bldg., New York 1.

▸ *AIR CONDITIONING*—New literature from manufacturer discusses new "Recold" model "RE" air conditioner designed for motel, hotel, residential use. Refrigeration Engineering, Inc., 7250 E. Slauson Ave., Los Angeles 22.

▸ *AIR DIFFUSERS*—Bulletin K-33, 48 pages, discusses manufacturer's high pressure air diffusers. Use, engineering considerations, duct designs, typical layouts, velocity and pressure factors covered. Connor Engineering Corp., Danbury, Conn.

▸ *AIR POWERED TOOLS, HOISTS, MOTORS*—New 52 page form 5200-A catalogs, illustrates, gives case histories for, gives specifications for company's line of "Impactools" for industry. Ingersoll-Rand Co., 11 Broadway, New York 4.

▸ *ALLOY*—New 4 page folder gives performance data on company's corrosion-, heat-resistant alloy formu-

RECENT TRADE LITERATURE
Continued

lated for temperatures to 1300 F. Application information, physical and mechanical properties included. Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22.

▸ *BLOWERS*—Unique looseleaf file folder covers component parts, graphs, tables, etc. for manufacturer's line of blowers for heating, air conditioning. Morrison Products, Inc., 16816 Waterloo Rd., Cleveland 10.

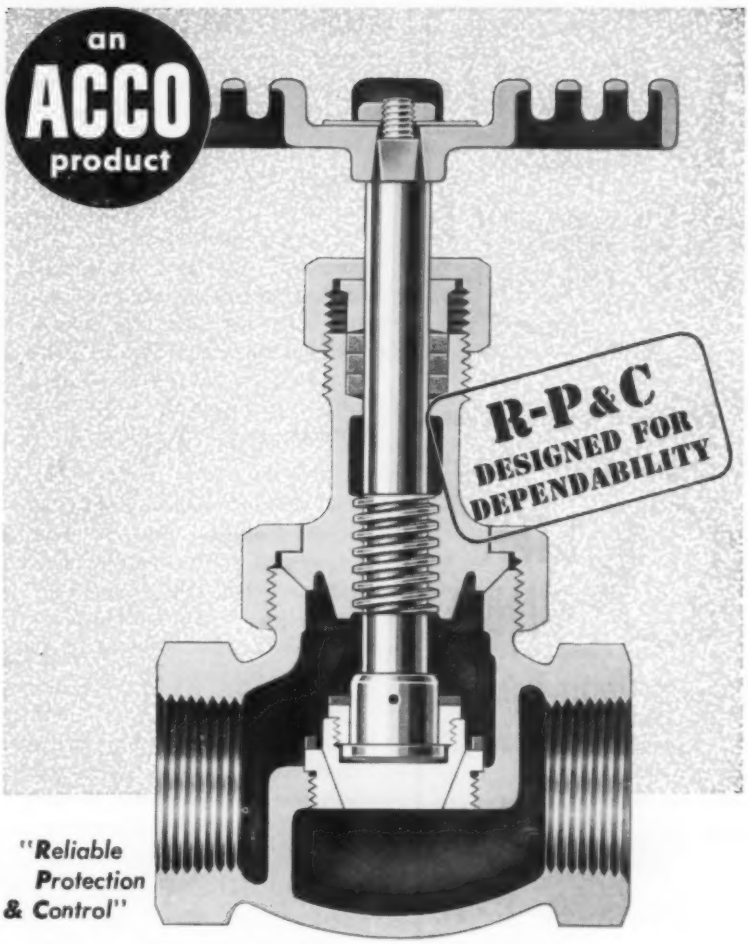
▸ *CAPS, PLUGS*—New 4 page catalog No. 55-1 lists sizes, specifications for "Shurclose" caps, plugs designed for protecting, sealing, masking tubing, fittings, valves, etc. Ray A. Scharer and Co., 3000 E. Grand Blvd., Detroit 2.

▸ *COLLECTING ELECTRIC FURNACE FUME*—New Bulletin offers four illustrated case histories showing use of company's "Distube" cloth-tube-type collectors, designed to trap furnace fume before it escapes to atmosphere. American Wheelabrator & Equipment Corp., 1321 S. Byrkit St., Mishawaka, Ind.

▸ *COMMERCIAL VACUUM*—Catalog sheet lists features, basic specifications for "Spic-Span" model "950H" commercial vacuum for cleaning furnaces, air conditioning systems. Premier Co., 755 Woodlawn Ave., St. Paul.

▸ *COMMERCIAL WATER HEATER*—Bulletin CH-122 describes "Burkay" commercial water heater, including new thermostat said to proportion gas input to hot water flow rate and temperature to which water must be raised. Permaglas Div., A. O. Smith Corp., Kankakee, Ill.

▸ *CONDENSATE CORROSION*—New folder outlines how different types of plants solved condensate cor-



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R-P&C's new **Fig. 427-DP** bronze globe valve is recommended for steam, water, oil and gas service where control or regulation of flow is required. Its 500 Brinell stainless steel seat and disc resist wire-drawing—make it particularly suitable for continuous throttling and other severe applications.

• The Fig. 427-DP is packed with the quality features that users expect from R-P&C. For example, the union bonnet for added strength and convenience, and a disc and seat ring construction which permits regrinding without removing the valve from the line. The full-plug construction, with its exceptional wide seating surface, gives closer control, longer life.

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RECENT TRADE LITERATURE

Continued

rosion problems. Hall Laboratories, Inc., 323 Fourth Ave., Pittsburgh 30.

▸ *CONDENSING UNIT, COOLING COILS, CONDENSER*—Specifications on operation, construction, condenser coil and fans; dimensions; and duct connections sizes for company's air cooled condensing unit, remote duct cooling coils, air cooled condenser presented in new literature. Bulletins C-1100-S93, C-1100-S92, Worthington Corp., Harrison, N. J.

▸ *CONTROLS*—Technical data, operational diagrams, schematic drawings, general information on manufacturer's series 400 "Capacitrols" presented in 16 page bulletin No. 9 Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

▸ *CONTROLS*—New 4 page catalog, bulletin A1.3-1, illustrates, gives brief description of function, working principles of each unit in company's "Autronic" control systems. Swartwout Co., 18511 Euclid Ave., Cleveland 12.

▸ *CONVERTORS*—Twelve page catalog features two and four pass convertors for controlled steam heating recirculated water for hot water, radiant heating systems. Alstrom Corp., 790 E. 176th St., New York 60.

▸ *CONVERTORS*—New 16 page bulletin No. 62 contains dimensions, rating tables, conversion tables, radiant heating ranges for company's convertor line. Whitlock Mfg. Co., West Hartford 10, Conn.

▸ *COOLERS*—Literature from manufacturer covers unit coolers designed for balanced performance in water defrost, water defrost ammonia types, units for room temperatures above 34 F. Table of dimensions, specifications given for each. Drayer-Hanson, Inc., 3301 Medford St., Los Angeles 63.

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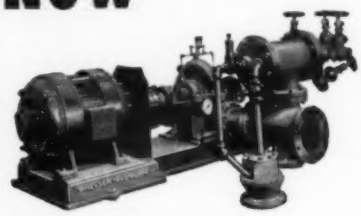

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RECENT TRADE LITERATURE *Continued*

▸ *COOLING TOWERS—Cooling Tower Wood Can Be Protected,* technical paper No. 130, discusses how chemical, bacteriological attack can be controlled by acid treatment, wood preservatives to kill fungi. W. H. & L. D. Betz, Gillingham and Worth Sts., Philadelphia 24.

▸ *ELECTRONIC METER*—Bulletin 105 covers company's line operated electronic pH meter, model "110." Has 7 in. scale length designed to cover pH range 0 to 14 without switching, reversal of pointer travel. Photovolt Corp., 95 Madison Ave., New York 16.

▸ *ELECTRIC OIL HEATING*—New 8 page bulletin covers manufacturer's electric lineal heaters for fuel oil suction piping. Illustrated with typical wiring diagrams. Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23.

▸ *EXHAUSTERS*—Information, performance tables on company's new axial mushroom power room exhausters contained in new bulletin CAM-102. Units designed for industrial, commercial applications where roof ventilation applicable, with or without duct systems. Chicago Blower Corp., 9869 Pacific Ave., Franklin Park, Ill.

▸ *EXPANSION BOLTS*—Dimensional chart for expansion bolts, screw anchors designed for contractors, architects, maintenance men, etc. Rawlplug Co., 271 Church St., New York 13.

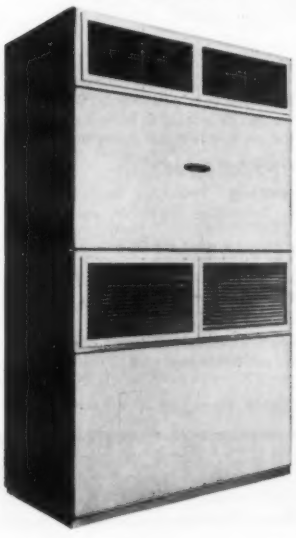
▸ *FLEXIBLE METAL HOSE*—Twelve page catalog No. 147 covers corrugated metal hose, convoluted hose, stainless steel flexible metal hose, special purpose assemblies. Coupling data included. Flexonics Corp., 1391 S. Third Ave., Maywood, Ill.

▸ *FLOW METERS*—Pneumatic flow meters, designed for operation in water and sewage plants, discussed in new 4 page folder. Contains illustrations, diagrams of typical installations. Builders-Providence, Inc., 345 Harris Ave., Providence, R. I.

▸ *FUEL—Anthracite for Space Heating* is engineering appraisal of factors involved in fuel, equipment selection. Four page reprint from Anthracite Information Bureau, 380 Madison Ave., New York 17.

▸ *FURNACES, HEATERS*—New literature from manufacturer covers the following: Bulletin B-55-US, sus-

Industrial Plants Stores Restaurants Offices



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RECENT TRADE LITERATURE *Continued*

pended gas unit heaters; B-55-D, small capacity duct furnaces; B-55-DS, sectional duct furnaces; B-55-P, automatic gas horizontal furnaces. Reznor Mfg. Co., Mercer, Pa.

▸ *HOT WATER REQUIREMENTS*—Chart lists average hot water requirements for tankless volume water heating. Specifies number of gallons to be used per hour for types, sizes of buildings. Portmar Boiler Co., Inc., 193 Seventh Ave., Brooklyn 15.

▸ *HUMIDIFIER*—Four page brochure covers company's new humidifier designed to handle humidity with very close control for 15,000 cu ft. Graphic Arts Div., Southworth Machine Co., 30 Warren Ave., Portland, Me.

▸ *INPUT CONTROLLER*—Bulletin F 5726-1 describes "Inputrol" automatic input controller for electric loads, flow of liquid or gas to process in accordance with changes in measured variable. Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

▸ *LIGHT, POWER TIME SWITCHES*—Bulletin 155 describes variety of switches available, shows which type for specific applications. Covers single pole, double pole, triple pole, double throw, two circuit switches. Also housings, dials. Tork Clock Co., Inc., Mt. Vernon, N. Y.

▸ *LIQUID EJECTOR*—"Hydro-Ejector" jet pump designed to pump mixture of liquid, solids through pipeline discussed in data sheet Ea. Table on capacities, related data included. Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa.

▸ *MOTORS*—New 28 page catalog contains buying information on a-c motors. Special section on integral horsepower motors covers horsepower requirements, enclosures, starting current limitations, speeds, motor types, selection of fuses and circuit breakers. General Electric Co., Schenectady 5.

▸ *NICKEL ALLOYS*—Corrosion-resistant cupronickel alloys containing 10 to 30 percent nickel for heat exchanger tubes in marine, power service covered in 12 page reprint available from International Nickel Co., Inc., 67 Wall St., New York 5.

▸ *PIPE LINE FILTERS*—Type "PL" pipe line filters, designed for water, oil, dirt, pipe scale removal from

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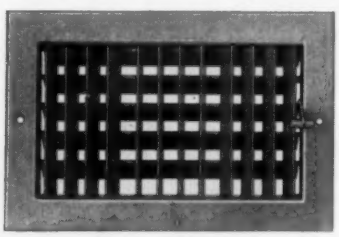

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RECENT TRADE LITERATURE *Continued*

compressed air, gas lines, detailed in manufacturer's brochure. Contains engineering, operation, application information. Air-Maze Corp., 25000 Miles Rd., Cleveland 28.

▸ *PIPE MARKERS*—New 4 page catalog covers company's "Speedy Marx" self adhesive pipe markers for identification. Pressure sensitive, some are said to resist heat to 400 F. North Shore Nameplate, Inc., 214-08 43rd Ave., Bayside, N. Y.

▸ *PLASTIC FABRICATIONS, PIPE*—New 8 page bulletin outlines use of company's polyvinyl chloride in fabrication of exhaust systems, processing equipment. Contains section on plastic pipe, fittings. Atlas Mineral Products Co., Mertztown, Pa.

▸ *PUMP*—Leaflet gives design information, capacity chart, maintenance hints, application data for company's "X-B" pump, designed to handle corrosive chemicals, abrasive slurries. Vanton Pump & Equipment Corp., 201 Sweetland Ave., Hillside, N. J.

▸ *PUMPS*—Small rotary displacement, centrifugal pumps for chemical service described in illustrated 4 page folder. Table of recommended uses, specifications for each unit, illustrations of mountings and drives contained. Eco Engineering Co., 12 New York Ave., Newark 1.

▸ *REFRIGERATION*—New 16 page catalog covers company's low temperature refrigeration equipment. Includes illustrations, system diagrams, specifications. Bush Mfg. Co., 179 South St., West Hartford, Conn.

▸ *REGULATOR*—Features, specifications for "Rimcor" model "SA" master regulator for automatic combustion control of package boilers presented in bulletin E-102. Reliance Instrument Mfg. Corp., 190 Glen Cove Ave., Glen Cove, Long Island, N. Y.

▸ *ROOF EXHAUSTERS*—New literature covers manufacturer's "AirMpeler Loboy" roof or relief caps, ventilating, exhaust systems. C. L. Ammerman Co., 110 N. Second St., Minneapolis 1

▸ *ROTAMETERS*—New 8 page bulletin No. 130 covers company's armored rotameters with "Mag/Na/Vue" indicating extension tube of nonmagnetic metal replacing customary glass tube. Designed for pressures to 1200 psi at 200 F, or metering opaque fluids. Brooks Rotameter Co., Lansdale, Pa.

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having twins!

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AND, both will be air conditioned for year-round comfort by Drayer-Hanson's popular heavy air-handling units – Flexazone's and HH's. Over 521,000 cfm's in all! Look at the "extras"... Electrically-welded angle-iron frame construction, vinyl-coated glass fibre insulation... and more. Details? Request bulletins C-4.20, C-4.22.A.

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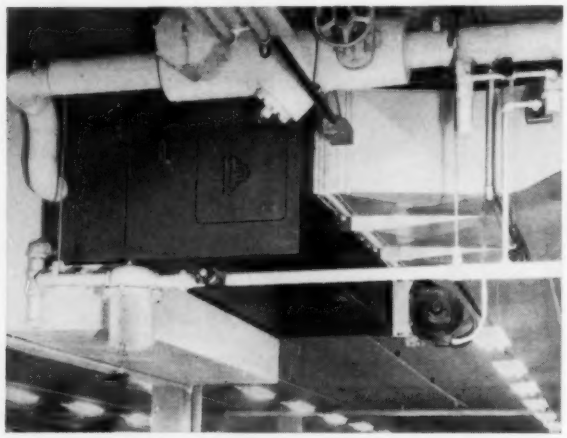

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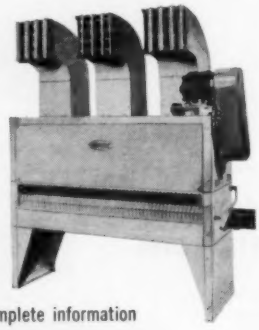

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*Business*_____

*Address*_____

RECENT TRADE LITERATURE *Continued*

▸ *SMOKE DENSITY INDICATOR, ALARM*—Features, specifications, steps to set equipment in operation covered in bulletin E-103. Reliance Instrument Mfg. Corp., 190 Glen Cove Ave., Glen Cove, Long Island, N. Y.

▸ *SOLID-LIQUID PROPORTIONING—What's Available Today for Automatically Proportioning Liquids and Solids* is divided into two parts. One deals with automatic proportioning of liquids; the other with solids. Contains diagrams, tables, typical installation drawings. B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I.

▸ *STAINLESS STEEL TUBING*—Brochure HES-1 covers manufacturer's stainless steel tubing for heat exchangers, condensers. Two typical ASTM specifications broken down to show how tubing meets requirements. 12 pages. Republic Steel Corp., Steel and Tubes Div., 224 E. 131st St., Cleveland 8.

▸ *STEAM FLOW CONTROLLER*—Bulletin contains specifications, illustrations, features for steam flow controller for water heaters, temperature controller for other applications. Aerco Corp., P. O. Box 248, Northvale, N. J.

▸ *STEAM TRAPS*—Bulletin No. 255 describes company's new thermodynamic steam trap, explains why very little maintenance required. Two color, 4 page folder lists features. Sarco Co., Inc., Empire State Bldg., New York 1.

▸ *SUPPLIES, EQUIPMENT*—Wholesaler-manufacturer's 36 page catalog is selection, pricing guide for heating, ventilation, air conditioning, refrigeration supplies and equipment. M. Blazer & Son, 173 Market St., Passaic, N.J.

▸ *TEMPERATURE CONTROL*—Application ideas, performance specifications for new remote bulb, adjustable temperature controller described in brochure MC-121. Available in two temperature ranges: 60 to 250 F, 200 to 550 F. Fenwal, Inc., Ashland, Mass.

▸ *TEMPERATURE CONTROL SYSTEMS*—Designed to help in selecting sensing elements and their correct use, bulletin F 6149-2 covers control terminology, rules for selection, explanation of various control system types. Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

▸ *THERMOSTATIC WATER MIXERS*—Illustrated folder CBG 55 describes various types of thermostatic

RECENT TRADE LITERATURE *Continued*

water mixing valves according to use. Gives technical details on sizes, capacities, other specifications. Leonard Valve Co., 1360 Elmwood Ave., Cranston 7, R.I.

▸ *TUBING*—Gage tolerances for cold, hot rolled carbon steel round welded mechanical tubing covered in 4 page folder. Nikoh Tube Co., 5000 S. Whipple St., Chicago 32.

▸ *UNIT AIR CONDITIONERS*—New 4 page bulletin No. 520-B illustrates typical installations, lists 25 features of company's line of unit air conditioners for commercial, industrial use. Frick Co., Waynesboro, Pa.

▸ *VALVES*—Data sheet DVa covers design, operation of manufacturer's materials handling valves. Four page bulletin illustrates valve construction, operation. Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa.

▸ *VALVES*—New 8 page two color catalog covers 55 different type bronze valves in variety of sizes. Illustration, description, size, weight given for each. Milwaukee Valve Co., 2375 S. Burrell St., Milwaukee 7.

▸ *VIBRATION CONTROL MOUNTINGS*—Bulletin K4A contains engineering specifications, performance data on 11 types of vibration isolating units. Selector chart covers wide range of equipment, shows recommended methods of isolation. Korfund Co., Inc., Long Island City 1, N.Y.

▸ *WATER HEATER INSTALLATION*—Manufacturer offers information on new slide rule designed for determining sizing for commercial water heater installation. Has two faces, one for apartments, other for restaurants. Permaglas Div., A. O. Smith Corp., Kankakee, Ill.

▸ *WEATHER CONTROLS*—New 4 page folder explains benefits of indoor-outdoor building heat controls. Covers operation of three different control units for buildings of various sizes, heating systems. Automatic Devices Co., Inc., 714 Hillgrove Ave., Western Springs, Ill.

▸ *WELDING*—New 16 page "Rod Finder Guide" (TIS 1126) covers rod, flux, electrode recommendations for torch, metal arc joining, overlaying of all base metals. Tips on processing equipment, piping, etc. contained. Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N.Y.

SHAW

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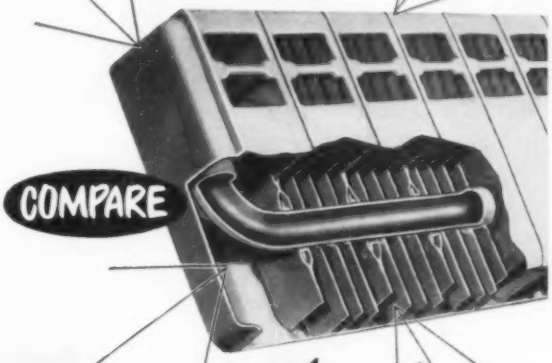

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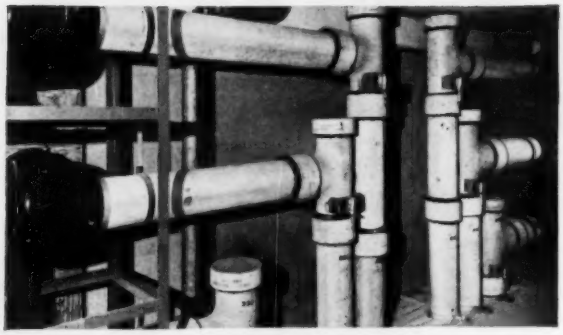
- lifetime beauty—no upkeep
- right or lefthand supply tapping
- factory assembled—one piece units
- fast, easy installation

Regardless of heat-source . . . steam or hot water . . . Shaw provides a perfect ratio of radiant-convected heat. Schools, Hospitals, Institutions, Office Buildings, Industry and the Home have long demanded a more compact and efficient radiator combining ruggedness of construction with beauty and efficiency.
There is a Shaw radiator available for every heating application. The Shaw Panel Baseboard with the long, low, thin look for modern baseboard heating. The Shaw Panel Radiator for under windows or areas requiring utmost efficiency and with small available space. The Perkins Industrial Radiator for the factory, warehouse, and where uniform, constant heat is desired and is not obtained with the on and off type blast heating common with unit heaters.

SP-3

SHAW-PERKINS MANUFACTURING CO.
201 EAST CARSON ST., PITTSBURGH 19, PA.

Indoors...



or outdoors...

TRANSITE INDUSTRIAL VENT PIPE

gives long, trouble-free service

If you need a vent with high corrosion resistance for indoor service, or one that will withstand the deteriorating effect of severe weather conditions, you can rely on Transite® Industrial Vent Pipe to do the job.

Made of two of nature's most indestructible minerals, asbestos and cement, Transite is highly resistant to the corrosive fumes, vapors and dusts that must so frequently be removed from research laboratories and industrial buildings.

Transite has a long record for standing up in all types of weather. It never needs painting or other preservative coatings. It will provide long, trouble-free service without maintenance.

Transite Industrial Vent Pipe offers other advantages, too. It is easy to install because it is light in weight and can be handled readily. No special equipment is needed for cutting on the job. A wide variety of fittings and pipe sizes make it adaptable to every industrial venting service.

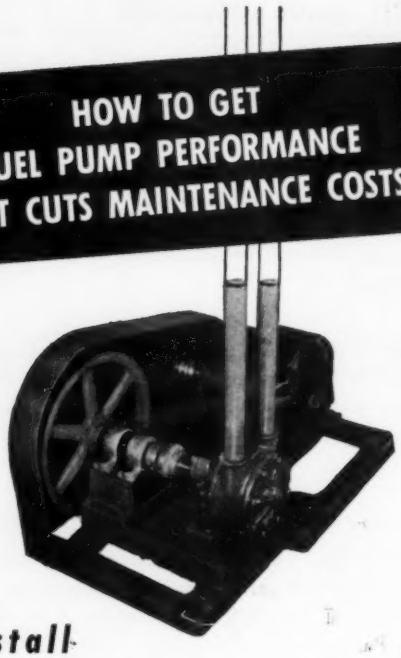
For additional information about the use of Transite Industrial Vent Pipe for your venting problems, write to Johns-Manville, Box 60, New York 16, New York.

Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE

AN ASBESTOS-CEMENT PRODUCT

HOW TO GET FUEL PUMP PERFORMANCE THAT CUTS MAINTENANCE COSTS



Install

TUTHILL TYPE SU *Pumping Units*

For Dependable Service in Industrial Heating

Tuthill Type SU multiple V-belt pumping units provide structural and performance advantages for dependable, uninterrupted operation that add up to reduced maintenance expense.

Features like these make the SU outstanding for handling heavy fuel oils in industrial heating:

- ★ **Motors up to 5 h.p. mounted on slotted slide rails for easy adjustment or replacement. No drilling or tapping required.**
- ★ **Cast iron base with mounting bolts and adjustments easily accessible.**
- ★ **One-point belt-tension adjustment.**
- ★ **Jack shaft, supported by ball-bearing pillow blocks, carries entire weight of pulley and absorbs belt tension.**
- ★ **Pump, jack shaft and pillow blocks available as separate unit.**
- ★ **Pump and jack shaft direct-connected by flexible coupling for better alignment and simplified mounting.**
- ★ **Wide range of pump models and capacities.**

Complete data is presented in Tuthill Catalog No. 107. Write for your copy today.

TUTHILL PUMP COMPANY

Dependable Pumps since 1927

939 East 95th St., Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. Ingersoll, Ontario, Canada

WHO'S WHAT . . .

▸ *BAKER, SMITH & CO., INC.*—Benjamin S. Bacon, vice chairman of the board; Bruce A. Jacobi, president. Mr. Bacon's election coincided with his completing 50 years of service with the company. Mr. Jacobi was formerly chief engineer for Lerner Corp. and resigned his position with that company to accept this new post.

▸ *AMERICAN GAS ASSOCIATION*—Chester S. Stackpole, managing director. Mr. Stackpole was formerly general sales manager, Heating and Cooling Div., Union Asbestos & Rubber Co.

▸ *SHEET METAL CONTRACTORS' NATIONAL ASSOCIATION*—Newly elected officers: Paul Stromberg, president; W. A. Kuechenberg, first vice president; Nat N. Leas, second vice president; Clarence J. Meyer, third vice president; Charles H. DeLaughter, treasurer. New directors are Andrew Stuart, Walter F. Limbach, Glen Angermann, J. Frank Park.

▸ *OIL-HEAT INSTITUTE OF AMERICA, INC.*—Elected officers: George E. Hochstein of The Heil Co., president; C. T. Burg of Iron Fireman Mfg. Co., P. G. Crewe of Webster Electric Co. and Claude A. Potts of Stewart Warner Corp., vice presidents.

▸ *NATIONAL-U.S. RADIATOR CORP.*—Carroll M. Baumgardner, senior vice president for sales; Louis N. Hunter, senior vice president for engineering and research; Howard B. Steggall, senior vice president for manufacturing; John C. Haas and F. M. Swartz, vice presidents for manufacturing; Edmond J. Grady, vice president of Pacific Steel Boiler Div.; Marion I. Levy, vice president for Viking Div.; J. Roy Knox, vice president for heating and air conditioning division.

▸ *L. J. WING MFG. CO.*—Newly elected officers are: H. S. Wheller, president and general manager; C. H. Smith, vice president and treasurer; H. S. Wheller, Jr., vice president and secretary; T. R. Peyrek, vice president in charge of Heating & Ventilating Div.; C. R. Mayer, assistant treasurer.

▸ *SORENG PRODUCTS CORP.*—Paul G. Frerer, vice president. He previously held the post of chief engineer.

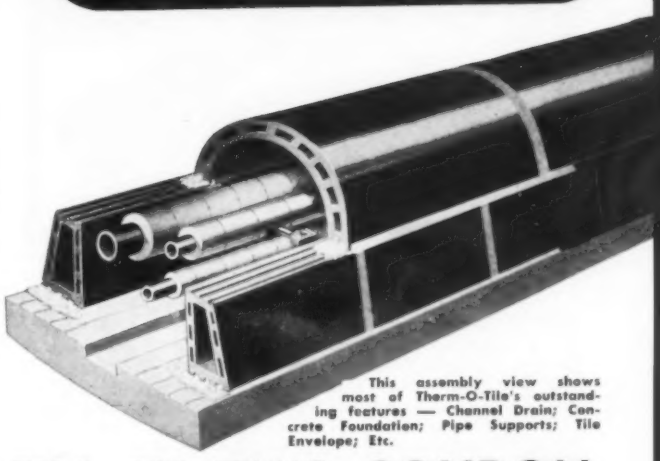
▸ *INSULMASTIC CORP. OF AMERICA*—H. L. Stockdale, president. Mr. Stockdale succeeds Clifford Off.

Therm-O-Tile

REG. U.S. PAT. OFFICE

CONDUIT FOR UNDERGROUND PIPING

• PERMANENT • ECONOMICAL
• SIMPLE • EFFICIENT



This assembly view shows most of Therm-O-Tile's outstanding features — Channel Drain; Concrete Foundation; Pipe Supports; Tile Envelope; Etc.

FILL IN THIS COUPON

CLIP OUT AND MAIL TO US.

Therm-O-Tile engineers and representatives will quickly and gladly cooperate with you.

H. W. Porter & Co., Inc.,
822-H Frelinghuysen Ave., Newark 5, N.J.

Without obligating us in any way,
☐ Please send your new Bulletin No. 10154
☐ Send representative.
☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Name .....

Firm .....

Street .....

City ..... State .....

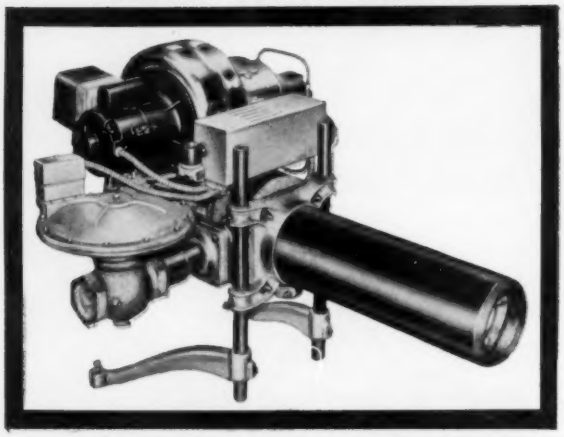
H. W. PORTER & CO., INC.
822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.
BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

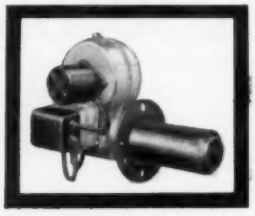
Insulation Engineers & Contractors

no pulsation!

the Syncro-Flame Dual-Fuel and Power Gas Burners will fire without PULSATION all types of boilers, warm air heating units and SCOTCH MARINE BOILERS



the burner head design of Syncro-Flame Dual-Fuel and power gas burners permit firing at rated inputs without pulsation. Syncro-Flame's Dual-Fuel burns either gas or oil at maximum efficiency—fuel/air changeover is automatic—operating by either outside thermostat or remote manual control. Syncro-Flame's Dual-Fuel unit is the most reliable of all. . . . Approved over the entire range of operation by Underwriters Labs. Write for spec. sheets and verified facts on savings your processing customers can make by using dual-fuel—burning gas in the off-peak season, or when the load is low.



syncro-flame power gas . . .

these burners operate at maximum efficiency . . . using the same high efficiency head with forced mixing of fuel and air . . . a short, swirling flame works where you need it . . . not on the furnace wall.

You're money ahead buying an approved and field proven unit. Syncro-Flame burners have been in constant use since 1951. 75,000 to 4,100,000 BTUs/hr. capacities.

syncro GAS flame BURNER

syncro DUAL GAS-OIL flame BURNER

synchronous flame inc.

208 n. main st., walworth, wisconsin

WHO'S WHAT

Continued

▸ *ADACHE & CASE, ENGINEERS*—Val Cotman, Jr., appointed to staff. Mr. Cotman's previous associations have been with Ric-Wil Co., where he served as vice president in charge of engineering, and, most recently, as consultant and advisor to the Universal Sewer Pipe Corp., directing the operations of its Steam Conduit Div.

▸ *INTERNATIONAL NICKEL CO., INC.*,—Vernon C. Robinson, a member of the Twin Cities technical field section of the company's development and research division in Minneapolis; Howard N. Farmer, Jr., a similar post in Los Angeles for the West Coast section.

▸ *NATIONAL DISTRICT HEATING ASSN.*—Elected at annual meeting were: Vernon J. Suche of Union Electric Co. of Missouri, St. Louis, president; Walter M. Gillespie of Dayton Power and Light Co., first vice president; John F. Haroldson of Duluth Steam Corp., second vice president; William G. Gillim of Consolidated Edison Co. of New York, Inc., third vice president; John F. Collins, Jr. of Pittsburgh, secretary-treasurer. Directors are: Norman H. Davidson, Rochester Gas and Electric Corp.; Albert F. Metzger, Allegheny County Steam Heating Co., Pittsburgh; William R. Owen, Central Station Steam Co., Detroit.

▸ *MICHIGAN ENGINEERING SOCIETY*—Samuel D. Porter of McNamee, Porter & Seeley Consulting Engineers, president; M. Eugene Malone of Gas & Steam Distribution, Consumers Power Co., vice president.

▸ *MITCHELL MFG. CO.*—Frank J. Scire, chief engineer of the air conditioning division, supervising engineering for room air conditioners, central systems, and dehumidifiers; William E. Smith, vice president in charge of purchasing.

▸ *FEDDERS-QUIGAN CORP.*—Robert H. Meyerhans, director of engineering.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Henry F. Dever, president of the Scientific Apparatus Makers Assn. Mr. Dever is president of the company's Brown Instruments Div.

▸ *D. J. MURRAY MFG. CO.*—A. W. Plier, reelected president and general manager.

▸ *WESTINGHOUSE ELECTRIC CORP.*—Chris H. Bartlett and Charles C. Shutt, vice presidents. Both are career men with the company, having joined in 1928 and 1926, respectively.

WHO'S WHAT

Continued

▸ *ALLIS-CHALMERS MFG. CO.*—Robert S. Stevenson, president. Mr. Stevenson had been executive vice president since July 1952. He succeeds the late William A. Roberts, who died April 12.

▸ *BORG-WARNER CORP.*—Roy C. Ingersoll, president and chairman of the board of directors. Elected to the board are L. G. Porter, administrative vice president; Robert W. Murphy, vice president and general counsel; Albert Steg, treasurer and controller.

▸ *UNION ASBESTOS & RUBBER CO.*—William G. Smith, national service manager for the company's air conditioning products.

▸ *VERMICULITE INSTITUTE*—Dayton L. Prouty, president. Mr. Prouty is vice president of Zonolite Co. Charles Goyer of Montreal and C. H. Wendel of Los Angeles were named to the board of directors.

▸ *VIKING AIR CONDITIONING DIV., NATIONAL-U. S. RADIATOR CORP.*—Richard F. Gang, general sales manager. For the past four years Mr. Gang has been assistant sales manager.

▸ *GENERAL CONTROLS CO.*—Sumner Ladd, manager of the company's Industrial Controls Div. Previously Mr. Ladd served as a factory sales engineer.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *FAIRBANKS CO.*—Paul Franke, representative for northern Illinois, Iowa, southern Wisconsin.

▸ *UNION ASBESTOS & RUBBER CO.*—Air Equipment Distributors, Inc., representative in New York metropolitan area; Noland Co., Inc., distributor in area of Spartanburg, S. C.

▸ *EDWIN L. WIEGAND CO.*—Harold Miles and Assoc., sales engineers for Tennessee, northern Alabama.

▸ *WORTHINGTON CORP.*—Loeffler-Greene Supply Co., wholesale distributor for Oklahoma City and other parts of the state; Straus-Frank Co., a similar appointment for Dallas and north Texas area; J. A. Klaiber, district supervisor of company's air conditioning and refrigeration division in St. Louis; J. H. Loomis, manager of St. Louis office.

How miller welders helped seal the arteries of America's largest single purpose power plant...

Substantial monument to Free Enterprise is OVEC and IKEC, suppliers of electric power to the Atomic Energy Commission's new uranium diffusion center in Pike County, Ohio.

Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation, agreed to supply electric power to this great new atomic production center . . . *15 billion kilowatt-hours annually.*

Two huge generating stations are being built: The Kyger Creek Plant at Cheshire, Ohio will have five generating units of 200,000 KW each; Madison, Indiana's Clifty Creek plant will produce 1,200,000 KW with its six big generators. Each of the eleven turbo-generating units will operate off a single boiler, with super-heated steam reaching 1,050 degrees Fahrenheit under 2,000 lbs. pressure per square inch! The high temperatures and reheat, which the sponsor companies have pioneered in their own right, will make these two plants among the most economical, most efficient generating stations in the country.

These same elements, however, make the fabrication of faultless high-pressure steam lines vital . . . and extremely difficult. To accomplish this extremely important task, pipe welding specialists equipped with the maximum of engineering skill utilized the Miller Selenium Rectifier d-c Arc Welder.

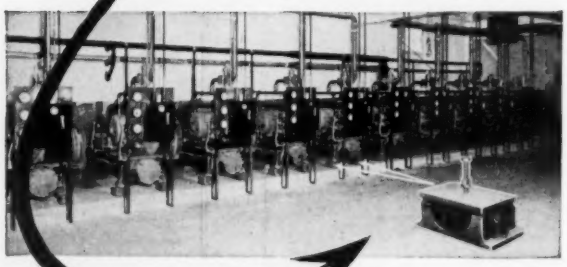
"....if it's Miller, you *know* it's the *finest!*"

Miller Selenium Rectifier d-c Arc Welder, in four wide-range models. For complete, concise, worthwhile information on these and other Miller Arc and Spot Welders, contact us today . . . at no obligation, of course.

miller

ELECTRIC MANUFACTURING COMPANY, INC.
APPLETON, WISCONSIN

STOP VIBRATION



with **KORFUND VIBRATION CONTROL**

Problem: When erecting a new office building, a prominent refrigeration equipment manufacturer wanted to install 41 of his units in two penthouses. Light-weight flooring with 40 foot spans between columns was planned. Vibration and noise transmission had to be prevented.

Solution: Korfund steel spring Isolators and Elasto-Rib pads completely prevented vibration and noise transmission, eliminated all bolting to the floor, and made economical light-weight floor construction possible.

In Air Conditioning, Korfund Vibration Control has paid off in dollars and cents for thousands of Engineers and Contractors, because Korfund units reduce transmitted vibration and:

- Permit installation *anywhere* in apartment, public, and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds
- Reduce maintenance costs
- Insure quieter operation

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment, write today for your free copy of Bulletin #2, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half century of experience is at your disposal.

KORFUND VIBRATION CONTROL — SPRINGS, RUBBER, CORK

THE KORFUND CO., INC.

48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

WHO'S WHAT

Continued

▸ *GENERAL ELECTRIC AIR CONDITIONING DIV.*—Field representatives and their territories are: Bernard S. Bernard, Washington, D.C.; Martin R. Ayers, Tennessee, Mississippi, Alabama, New Orleans area from Memphis; Herman Van Nelson, Montana, Idaho, Utah, Washington, Oregon, Colorado; A.J.D. Helwig, New England states, New York, New Jersey, Pennsylvania, Delaware; Frank J. O'Connor, North and South Carolina.

▸ *ROBERT MFG. CO.*—New branch office in Ft. Worth, headed by Howard Burch, covers Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Tennessee, Texas.

▸ *KRITZER RADIANT COILS, INC.*—Appointed representatives and their territories: Lamb Engineering Co., Baltimore; Thomas M. Walsh, northern California; Stringer Spencer Sales Engineers, Philadelphia; J. W. Cherry Co. Shreveport.

▸ *DUTTON BOILERS DIV. OF HAPMAN-DUTTON CO.*—Merrill N. Musgrave Co., distributor for Washington, Oregon, Montana, Alaska, part of Idaho; Bushnell Controls & Equipment Co., Inc., representative for northern California.

▸ *SARCO CO., INC.*—Hoffman & Hoffman Co., sales representative in North and South Carolina.

▸ *KRAMER TRENTON CO.*—Hans P. Peterson, covering firm's northern New Jersey territory.

▸ *FEDDERS-QUIGAN CORP.*—Joseph H. Marshall, midwest regional sales manager; Armstrong Supply Co., distributor in Salt Lake City area.

▸ *DEMING CO.*—Dexter F. Anderson, district representative covering 10 western states.

▸ *MAID-O'-MIST, INC.*—George Miller, covering Wyoming, Colorado, New Mexico, El Paso, Denver.

▸ *PRAT-DANIEL CORP.*—Lewis H. Dietz, far western sales director for company's Thermobloc Div.

▸ *ELLIOTT CO.*—F. L. Humphrey, Jr., district manager in Atlanta territory.

▸ *HALSTEAD & MITCHELL*—B. H. Nunnally, distributor for upstate New York, Connecticut.

WHO'S WHAT

Continued

▸ *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.*—Mel Jackson, sales representative in northwestern Indiana, Chicago's south side and adjacent suburbs; Walter H. Olin, covering New Mexico and west Texas.

▸ *HAMMEL-DAHL CO.*—Russell F. Clark Co., sales and service representative in western Pennsylvania and part of West Virginia.

▸ *ATLAS VALVE CO.*—Stanley M. Proctor, Ohio territory representative.

▸ *BRISTOL CO.*—John M. Maitland, manager of Detroit district office.

▸ *HEIL PROCESS EQUIPMENT CORP.*—Robert Scheel, head of Chicago office.

▸ *NATIONAL SUPPLY CO.*—Stuart F. Hatch, district manager of St. Louis office of the company's Spang-Chalfant Div.

▸ *WARNER ELECTRIC BRAKE & CLUTCH CO.*—John Dewey, Chicago branch sales manager.

▸ *BUSH MFG. CO.*—Frank Ross, sales engineer in Los Angeles territory.

▸ *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—R. H. Wittbolt Co., representative in Houston area; Swieco, Inc., Ft. Worth area.

▸ *DAY & NIGHT DIV., CARRIER CORP.*—Craig C. Stirewalt, northern California sales manager; Louis M. Hull, manager of new construction sales.

▸ *COOPER ALLOY CORP.*—Cameron & Barkley Co., distributor for stainless steel valves, fittings, accessories in South Carolina, Georgia and Florida.

▸ *CLEAVER-BROOKS CO.*—Delval Equipment Corp., boilers and equipment sales representative in Delaware, eastern Maryland, southern New Jersey, eastern Pennsylvania.

▸ *DRAVO CORP.*—Exclusive distributor of "Paracoil" heat transfer equipment through its Pittsburgh, Cleveland, Detroit offices. This equipment is manufactured by Davis Engineering Co.

No Other Vertical Wet Pit Centrifugal Pump will operate without bearing failure as long as

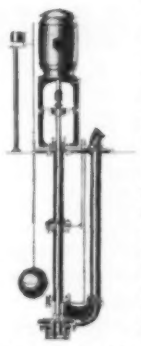
YEOMANS

Series 3000 and Series 8000 for Building and Industrial Service

LUBRI-VAC®, an exclusive Yeomans development, makes the difference.

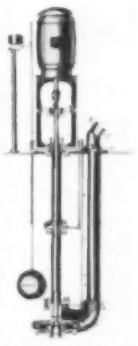
LUBRI-VAC secures the same kind of suction and pressure ABOVE the impeller as WITHIN the impeller, thus preventing entrained solids from being forced across the back of the impeller into the bearing to cause rapid wear.

LUBRI-VAC therefore increases Yeomans Series 3000 and Series 8000 pump life as much as 12 times beyond the normal expectancy of pumps not so equipped — reduces bearing failures and pump servicing by 90% to 95%.



Series 3000 Bilge or Sump Pump

Both Yeoman Series 3000 and Series 8000 Vertical Wet Pit Centrifugal Pumps incorporate LUBRI-VAC. Series 3000 Bilge or Sump Pumps are designed for solid-free liquids from drainage and seepage, sewage effluents and industrial process wastes. Series 8000 Heavy Duty Screenless Ejectors are recommended for liquids containing solids, dirt and trash; for heavy liquids, storm drainage and industrial uses.



Series 8000 Heavy Duty Screenless Ejectors

NEW, UP-TO-DATE CATALOGS AVAILABLE NOW!

Just off the press, these new Series 3000 and Series 8000 Catalogs present for the first time tabulations of construction materials best suited for problem materials, selection data and charts, construction features, dimension data, and variations. Mechanical Engineers-Process Engineers: These catalogs are important for your reference files. They contain the latest recommendations of the Hydraulic Institute.

Get copies from your local Yeomans representative listed in the yellow pages of your telephone book under "Pumps", or attach coupon to company letterhead and mail direct.

(R) Registered Trademark

Yeomans Brothers Company

2000-5 No. Ruby St., Melrose Park, Ill.

Send the new Vertical Wet Pit Centrifugal Pump Catalogs as checked:

—— Series 3000 Bilge or Sump Pump

—— Series 8000 Heavy Duty Screenless Ejectors

Name ..... Title .....

Company .....

Address .....

City ..... Zone .... State .....

get the inside story

on your **AIR FILTERS**

at a glance!

HAYS AIR FILTER GAGES

With an air filter gage you measure the resistance that air meets in passing through a filter—you get the *inside story* at a glance.

A dirt-clogged filter in air circulating or air conditioning systems lowers efficiency and costs you money. Needless changing of filters to avoid clogging is expensive. A small investment in a Hays air filter gage removes this guesswork . . . results in real savings.

Models and mountings available for every air filter use—features include:

- ***easy to read***—**the large dial is visible from a distance.**
- ***minimum maintenance***—**there is no oil to evaporate and no leveling is required.**
- ***constant accuracy*** — **Hays' special "slack diaphragm" retains accuracy.**
- ***easy zero check***—**external zero adjusting screw provided.**

Gages can be furnished with contacts for flash or sound alarms or with damper controls. Portable models also available.

For complete details on Hays Air Filter Gages, write for Bulletin 54-751-12.

THE **hays** CORPORATION

Michigan City 14, Indiana

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

WE HEAR THAT . . .

▸ *MIDWEST RESEARCH INSTITUTE* has formally opened its new modern research center in Kansas City, Mo. Several hundred business firms and industrial leaders of the Middle West contributed the $1,250,000 necessary for construction of the laboratory, consisting of 80,000 sq ft.

▸ *AEROVENT FAN CO., INC.* has released a new 16 mm sound film in color covering "Industrial Axial Flow Fans." It was produced in the company's engineering department as a part of an educational program for use in the recent Industrial Ventilation Conference.

▸ *WESTINGHOUSE AIR CONDITIONING DIV.* has opened a new plant in Staunton, Va. With an area of 301,080 sq ft, the plant is located on a 200 acre tract.

▸ A unique new method for handling, shipping and storing compressed gas cylinders has been developed by *GENERAL CHEMICAL DIV., ALLIED CHEMICAL & DYE CORP.*, for use with its "Genetron" refrigerants.

▸ *AEROQUIP CORP.* has announced the acquisition of *MARMAN PRODUCTS, INC.* Aeroquip will add the Marman clamp for joining pipes and other conduits to its line of flexible hose lines with detachable, reusable fittings and self sealing couplings.

▸ *GORDON & PIATT* has changed its form of business from a partnership to a corporation. *M. K. GORDON, JR.* is president, *S. ANDREW SWOYER* is vice president and *WILLIAM R. PIATT* is secretary-treasurer.

▸ *WATTS REGULATOR CO.*, now in its 80th year, recently held a national sales meeting attended by 56 agents from all over the United States and Canada.

▸ The 3000th centrifugal refrigerating machine made by *CARRIER CORP.* was shipped following ceremonies honoring 17 men, each of whom has had over 25 years of experience in the manufacture of the product.

▸ *Joining Makes the Difference* is a new 16 page brochure promoting the benefits of active participation in the *HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSN.*

▸ Two new educational talks with color slides on thermostatic expansion valves and the effects of moisture have been released by the *SPORLAN VALVE CO.* for presentation by the company's field representatives.

WE HEAR THAT

Continued

▸ Fact and fancy are combined in a new series of consumer advertisements for *CARRIER CORP.* air conditioning equipment. Made up of three cartoon panels in light style, combined with couplets, the series is backed by information as to what air conditioning has done for animals, and hence can do for humans.

▸ *UNISTRUT PRODUCTS CO.* has announced the release of a 16 mm color and sound motion picture titled, "The Sky's the Limit." It offers a complete and practical approach to the application and use of metal framing in industry.

▸ Sales of gilsonite in 1954 for insulation of heat underground steam, fuel oil and water pipes were more than double in volume over 1953, according to *E. F. GOODNER*, president of *AMERICAN GILSONITE CO.*

▸ *FEDDERS-QUIGAN CORP.* will move its sales, advertising, engineering and finance departments from Buffalo to the company's head offices in Long Island. The move is slated for completion by Labor Day.

▸ Officials of *BORG-WARNER CORP.* and *BYRON JACKSON CO.* announce that after negotiating for some time they have agreed and will recommend to their respective boards of directors that the two companies merge.

▸ Two of the coal industry's outstanding engineers received plaques for their contributions to industry-sponsored coal research when 1955 annual awards of *BITUMINOUS COAL RESEARCH, INC.* were presented to *EARL C. PAYNE*, consulting engineer, *PITTSBURGH CONSOLIDATED COAL CO.* and *JULIAN E. TOBEY*, president, *APPALACHIAN COALS, INC.*

▸ Testing of heating and air conditioning equipment was begun recently at the *UNION ASBESTOS & RUBBER CO.'s* new $100,000 research and development laboratory at Chicago.

▸ *GENERAL FITTINGS CO.* has moved to larger quarters in East Greenwich, R. I. Previously, they were located in Providence.

▸ Officials of *UNITED STATES AIR CONDITIONING CORP.* and *STERLING RADIATOR CO.* have announced the formation of a new company, *STERL-AIRCO, INC.*, owned jointly by both companies. It has taken over the manufacture, sales and distribution of gas fired unit heaters. Sterling has been manufacturing the usAIRco units under license.

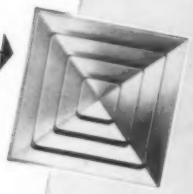
air patterns unlimited without blank-offs

AGITAIR Custom Made

AIR DIFFUSERS with DIFFUSING VANES

. . . better because

A good piece of equipment is no better than the experience behind it.

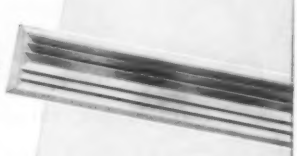


. . . better because

It's the original square and rectangular outlet . . . not just a poor imitation without distinctive features.

. . . better because

The company behind these diffusers has a history for doing things right and guaranteeing results.



you can depend on AGITAIR for better air

Your local AGITAIR representative will gladly assist you in selecting the proper size and air pattern to meet the requirements of your job. In addition, the engineering staff and laboratory resources of Air Devices Inc., are available to you.

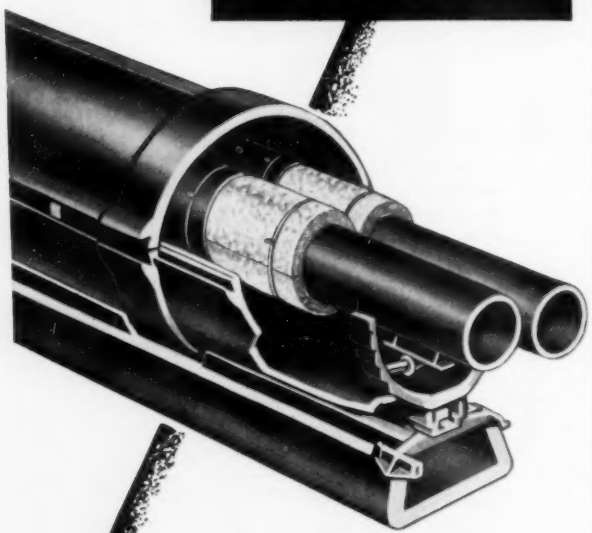
AIR DEVICES INC.

185 MADISON AVENUE NEW YORK 16, N. Y.

Air Diffusers • Filters • Exhausters

Two Reasons Why

Universal Vitrified Tile Conduit



offers you the greatest protection for underground insulated piping . . .

1. Made of hard surface salt-glazed vitrified clay — impervious to disintegrating action of electrolysis, water, acids, alkalies, rust, etc.

2. The special Universal feature — interlocking construction and continuous Key-Lock side joints — assure a completed assembly of all parts into a rigid, serviceable and water-tight whole.

Easy to Install • *Two Styles* • *Write for Catalog #54*

Now sold exclusively by:
MUNDET Cork Corporation Distributors

UNIVERSAL SEWER PIPE CORPORATION
Steam Conduit Division
1500 UNION COMMERCE BLDG. • CLEVELAND 14, OHIO

WE HEAR THAT

Continued

▸ Construction has begun on a 19,250 sq ft addition to the Philadelphia plant of *THE GRINNELL CO., INC.*, automatic sprinkler, valve and pipe fitting manufacturer, *THE BALLINGER CO.*, architects and engineers of that city, announced.

▸ *FAIRBANKS, MORSE & CO.* has opened a new sales and service headquarters in Fair Lawn, N. J. for a seven state area including Connecticut, New York, New Jersey, eastern Pennsylvania, Maryland, Delaware and Virginia. The company's Export Div. sales offices also are located in the new headquarters building.

▸ *LOCKWOOD GREENE ENGINEERS, INC.* has moved its New York offices to 41 E. 42nd St. in that city.

▸ The *SUNBEAM AIR CONDITIONER DIV.* of *AMERICAN RADIATOR & STANDARD SANITARY CORP.* is now known as the *AIR CONDITIONING DIV.* of American-Standard.

▸ *SLANT-FIN RADIATOR CORP.* has completed transfer to enlarged office and plant facilities in Richmond Hill (Queens), N. Y. The company was located in Brooklyn for many years.

▸ *TAYLOR INSTRUMENT COMPANIES* has moved its San Francisco offices and plant across the bay to San Leandro. The new building contains 16,800 sq ft of floor space.

▸ In a recent move to expand their warehousing and sales facilities, the *DIAMOND EXPANSION BOLT CO.* has established new facilities in Detroit.

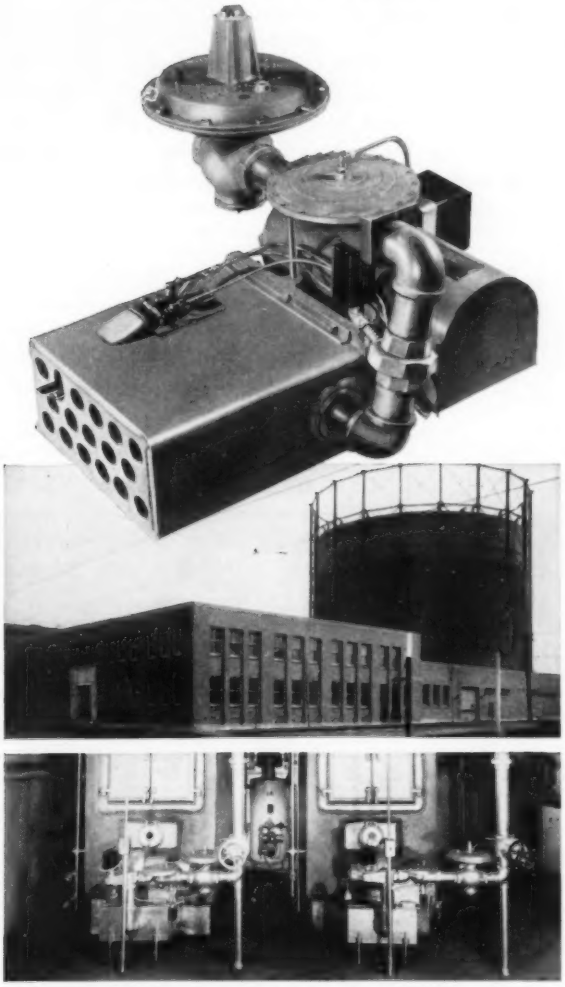
▸ In connection with the establishment of national headquarters of the *BRYANT DIV.* of *CARRIER CORP.* in Indianapolis, the firm has acquired an industrial site for administration, sales, engineering and research offices across from the manufacturing plant in that city.

▸ *R C. CASH*, sales representative for *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.* in Tennessee, Mississippi, Alabama and eastern Arkansas, has moved his headquarters from Memphis to Birmingham.

▸ For its annual sales meeting, *PRAT-DANIEL CORP.* temporarily transferred manufacturing activities from

LO-BLAST

THE POWER BURNER Gas Men Choose



Two 2,800,000 BTU Lo-BLAST Burners in service shop building of Peoples Gas Light & Coke Co., Chicago, Illinois. In addition, a Lo-BLAST Economite is used for water heating.

Lo-BLAST costs 10% less to operate—less to install

This burner uses an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air—always independent of natural draft—more efficient and dependable.

A high chimney is not needed and complete factory assembly reduces installation costs. Inshot design reduces maintenance. Each unit is factory tested on gas.

Capacities from 75,000 to 20,000,000 BTU input. Write for engineering data.

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METAL PRODUCTS CO.
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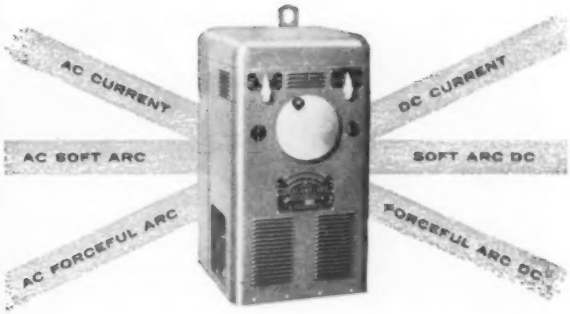
To cut costs . . .

YOU CAN NOW SELECT THE IDEAL ARC AC AND DC FOR EVERY JOB



In addition
LINCOLN IDEALARC *gives you*

- **hot starting on DC as well as AC**
- **operation on single-phase power**

Available in different sizes, you can buy Idealarc to furnish both AC and DC welding current or as a straight AC machine to which a DC unit can be added at a later date.

GET ALL THE FACTS
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THE LINCOLN ELECTRIC COMPANY
Dept. 3803 • CLEVELAND 17, OHIO
The World's Largest Manufacturer of Arc Welding Equipment

read low surface temperatures
in 5 Seconds Accurately!

On all Jobs...this instrument is invaluable for balancing hot water heating systems, reading floor, wall or ceiling temperatures, checking refrigerated coils, insulation and all other low temperature surfaces.

Quick Accuracy...the 2300 assures the highest standards of speed, accuracy and dependability—you can read most low surface temperatures in 3 to 5 seconds.

Saves Money...the speed and precision eliminate time-wasting rechecking. It is a direct reading unit —no conversion tables, balancing slide wires or batteries are necessary.

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WE HEAR THAT

Continued

its Thermobloc Div. plant, and then converted the plant into an exhibit hall.

▸ An unusual air conditioning training program is currently being conducted by the *ENTERPRISE HEAT & POWER CO.*, Chicago. Sales engineers are taught the construction, component parts, operation procedures and installation of three basic air conditioning lines. The first five day school was attended by 25 men. Additional schools will be held periodically throughout the season.

▸ A nine day trip to Paris was the reward for a group of appliance dealers and distributors, winners of the *MITCHELL MFG. CO.'s* "Early Bird" incentive travel contest, devised to spark early season sales of room air conditioners.

▸ For the second successive year, *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.* has been awarded the Certificate of Public Relations Achievement, Distribution and Marketing Classification, presented by the American Public Relations Assn.

▸ National sales of *SPRINGFIELD BOILER CO.'s* water tube package generators will be made through the sales network of *KEWANEE-ROSS CORP.*, it has been announced by officials of both companies.

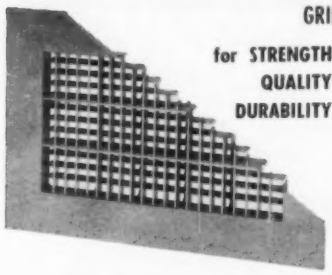
▸ The first annual Alexander Hamilton Free Enterprise Award for service in public relations has been awarded to *ROBERTSHAW-FULTONS CONTROLS CO.'s* Grayson Controls Div., Long Beach, Calif. The company's Fulton Sylphon Div. has opened a new warehouse at Lynwood for West Coast customers. The American Thermometer Div. has been renamed the American Controls Div. This division is located in St. Louis.

▸ The *VERMICULITE INSTITUTE* has announced that new ASTM specifications C332-54T and C331-53F covering vermiculite concrete aggregate have been issued. They detail density, insulation value, grading and other values. These specifications replace former ones written in 1942.

▸ "A Clean Start," a 15 minute color sound film, presents the values of 180 deg sanitizing rinse water and the place of the public health official in the restaurant business. The movie is produced by *PERMAGLAS DIV., A. O. SMITH CORP.*

THE SOLID BAR TYPE

GRILLE OR REGISTER



for STRENGTH
QUALITY
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in SCHOOLS

in HOSPITALS

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SPECIFY R. & G. ALL THE WAY!

Solid 14 gauge Bars make the Grilles and Registers rugged and long lasting. Their interlocking construction makes them Tamper-proof — adjustable only with special tool provided with each order. Where you want the best in construction and performance — there is no other choice. It's R & G all the way!

- Constructed of sturdy 14 gauge steel bars.
- Interlocking Cross Bars for Added Strength.
- Fixed Bars, single or double deflection.
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Complete Line of Registers and Grilles for HEATING VENTILATING AIR CONDITIONING

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Convert Stack Losses into BIG Fuel Savings

with a

PREFERRED DRAFT-A-JUSTOR

100% Statically Balanced. Impossible to Stick or Jam. Easy to Install and Adjust.

1—On top of breeching.
2—On side of breeching.
3—Under breeching.
4—At base of chimney.

In that next boiler installation be sure to include a Preferred Barometric Draft-A-Justor. Controls draft automatically and eliminates efficiency losses due to excess air. Thousands of these controls are saving millions of fuel dollars.

- Saves 10 to 30% in Fuel.
- Insures Perfect Draft Control.
- Cuts Losses from Brickwork Leakage.
- Increases CO_2 Percentage.
- Reduces Fly Ash Quantity up Stack.
- Cools Walls next to Chimney.
- Ventilates Boiler Room.

Sizes to meet every job. Approved by Underwriters' Laboratories, Inc. Write for Bulletin 800.

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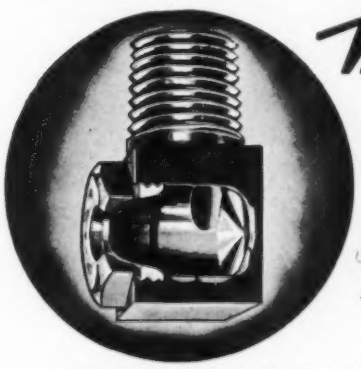

Monarch NOZZLES for AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from ⅛" to 1". ¼" size is 1-5/16" long and made from ⅝" square stock.

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SAVE on low initial cost, simple installation and efficient operation.

ENJOY fully automatic controls and years of dependable performance.

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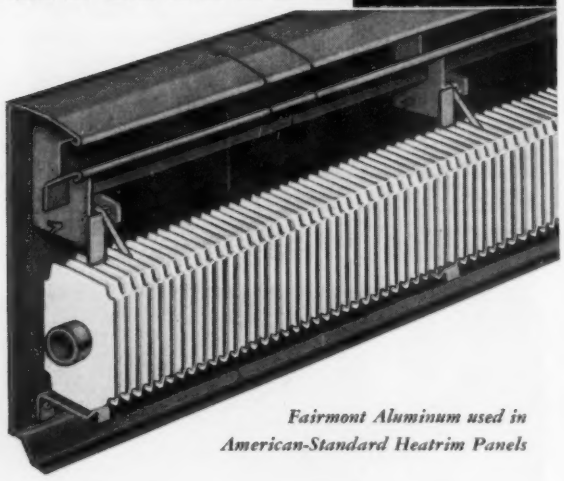
Arthur A. Olson & Company
Canfield, Ohio

Write for free catalog and complete information.

Write for bulletin and engineering data sheet

Better Yet,

USE FAIRMONT aluminum



Fairmont Aluminum used in American-Standard Heatrim Panels

In baseboard heating units, and in all better parts and accessories for heating and cooling applications, Fairmont 1100 and 3003 wrought aluminum sheet is nationally recognized for highest quality and uniformity. Improved appearance, high thermal conductivity, light weight, wear-resistant ductility, and non-corrosive and stainproof surfaces—all these objectives and more are readily achieved.

Fairmont bright aluminum rolling mill products —sheet, coil and circles, are now available for prompt delivery to meet manufacturing schedules.

FAIRMONT
ALUMINUM COMPANY
•
Fairmont, West Virginia

MEETINGS & CONVENTIONS

JUNE 6-9—*National Industrial Service Association, Inc.*, 22nd annual convention. Ten subjects of interest to electric motor, generator and transformer repair shops to be presented. Los Angeles. Registration: Horace Barks, NISA, 818 Olive St., St Louis 1.

JUNE 7-10—*American Welding Society*, 3rd annual show. Municipal Auditorium, Kansas City, Mo. The annual spring technical meeting is to run concurrently with the show. National secretary: Joseph G. Magrath, at the society, 33 W. 39th St., New York 18.

JUNE 12-15—*American Society of Refrigerating Engineers*, semi-annual meeting. Milwaukee. R. C. Cross, secretary, 234 Fifth Ave., New York 1.

JUNE 13-17—*National Association of Power Engineers, Inc.*, 73rd annual convention. Hotel Waldorf-Astoria, New York. Convention director: Thomas J. Barrett, NAPE, Room 775, Waldorf-Astoria, New York 22.

JUNE 13-17—*The Pennsylvania State University*, heat transfer short course conducted by the university's College of Engineering and Architecture. Write: General Extension. The Pennsylvania State University, University Park, Pa.

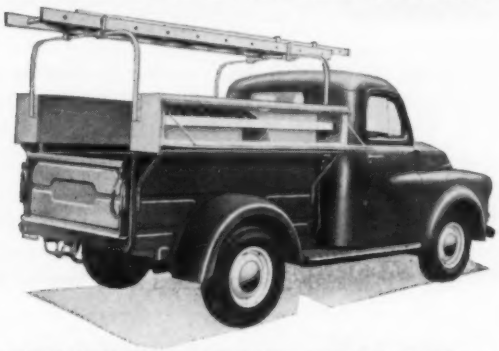
JUNE 15-17—*American Society of Mechanical Engineers*, conference on combustion to be held jointly with Great Britain's Institution of Mechanical Engineers. Massachusetts Institute of Technology, Cambridge. A similar conference will be held by the two societies in London, October 25-27, in the Great Hall of the Institution of Civil Engineers. Registration for the MIT conference: Mr. A. D. Blake, ASME, 29 W. 39th St., New York 18.

JUNE 19-23—*American Society of Mechanical Engineers*, Diamond Jubilee semi-annual meeting, Boston. Annual meeting is scheduled November 13-18 in Chicago. ASME headquarters, 29 W. 39th St., New York.

JUNE 20-24—*American Society for Engineering Education*, 63rd annual meeting. Hetzel Union Bldg., The Pennsylvania State University. Registration: Professor K. L. Holderman, 103 Mechanical Engineering Bldg., The Pennsylvania State University, University Park, Pa.

JUNE 27-*JULY* 1—*American Society for Testing Materials*, 58th annual meeting Chalfonte-Haddon

STAHL SIDE BOXES



CONVERT YOUR "PICK-UP" TO A MODERN SERVICE TRUCK!

Quickly...and at low cost...you can mount these All-Steel, Welded Side Boxes on ANY MAKE OR MODEL of pick-up truck. Keep tools and equipment dry, safe, organized.

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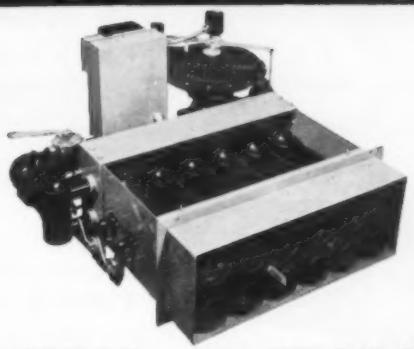
3490 W. 140th St. Cleveland 11, Ohio

for Gas Firing



The HORIZONTAL or TYPE "H" GAS BURNER **for Scotch Marine or other type boiler where the "Inshot" type of firing is preferred. Multiple flame retention heads assembled in a heavy gauge housing with balanced air louvres and specifically designed pilots provide the maximum in flexibility and dependability. Complete prewiring and factory assembly of controls simplifies, and cuts hours from installation time.**

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WINFIELD, KANSAS

Get the same air delivery with only ⅓ the weight!

Model BD-43 is only 41⅝" high, delivers up to 16,500 cfm

New COOK all-aluminum belt-drive centrifugal ventilator

- Saves up to 400 lbs. on large models
- Only 6" high roof curb required
- Weatherproof aluminum shell and base
- Aluminum centrifugal wheel
- Compact belt-drive
- Low silhouette
- Non-overloading wheel, low tip speeds
- Rubber-mounted drive assembly
- From 1,000 to 16,500 cfm

The new Cook Model BD belt-drive ventilator eliminates heavy roof loads. Model BD-43, 16,500 cfm size, weighs only 250 pounds. Low tip speeds assure quiet operation. Light starting torque of the aluminum blower wheel increases bearing, motor and belt life. Are also available in Direct Drive Models from 7" to 30" sizes. Write for Catalog BD.

HINGED HOOD, motor and belt-drive easily inspected.

EASY TO CLEAN. Remove four bolts and shell lifts off.

COOK VENTILATORS
LOREN COOK COMPANY
Berea, Ohio

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Gentlemen: Please ship me:

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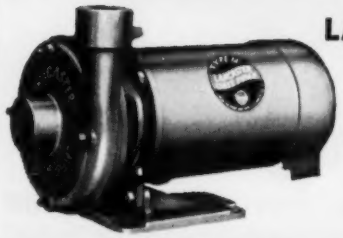

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from 2-50 H.P. and heads to 300'
Capacities to 1000 G.P.M.
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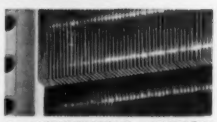
LANCASTER, PENNSYLVANIA

THE ONLY AIR-COOLED CONDENSER WITH THESE 2 ESSENTIAL FEATURES

REMPE "Atmos-Therm"®



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Special large volume gas inset section. Hot gas from compressor expands slightly to accelerate its transfer from a dry gas to a wet vapor. Completion of change is made in smaller tubes.

THE REMPE "ATMOS-THERM"

- Completely eliminates the need for condenser water.
- Minimizes operating and service expense.
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- Is adaptable to inside or outdoor installation.
- Outlasts cooling towers and evaporative condensers.

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2. AIR BLEEDER BAFFLE
Allows stream of air to be directed over all return bends for maximum efficiency. Return Bend Cover Plate perforated to allow measured amount of air to be directed over bends and headers.

HEAT TRANSFER EQUIPMENT REMPE CO. Established 1900

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MEETINGS & CONVENTIONS *Continued*

Hall, Atlantic City. The society is at 1916 Race St., Philadelphia 3.

JUNE 27-29—*American Society of Heating and Air-Conditioning Engineers, Inc.*, semi-annual meeting St. Francis Hotel, San Francisco, ASHAE headquarters, 62 Worth St., New York 13.

JULY 12-14—*Western Plant Maintenance Show.* Pan Pacific Auditorium, Los Angeles. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

SEPT. 12-16—*Instrument Society of America,* 10th annual conference and exhibit. Shrine Exposition Hall and Shrine Auditorium, Los Angeles. Show office: 3443 S. Hill St., Los Angeles 7.

NOV. 1-5—*World Symposium on Applied Solar Energy.* Westward Ho Hotel, Phoenix. Subjects to be discussed are space heating and cooling with solar energy, solar water heaters, mechanical energy from solar energy, direct conversion of solar energy and others. Symposium is cosponsored by the Association for Applied Solar Energy and Stanford Research Institute, Stanford, Calif.

NOV. 14-17—*2nd International Automation Exposition.* Navy Pier, Chicago. Exposition headquarters is at 845 Ridge Ave., Pittsburgh 12.

NOV. 14-18—*Chicago Exposition of Power & Mechanical Engineering.* Coliseum, Chicago. The exposition is being held in conjunction with the 75th Anniversary Meeting of the American Society of Mechanical Engineers. Management: International Exposition Co., Inc., 480 Lexington Ave., New York 17.

NOV. 27-30—*American Society of Refrigerating Engineers,* winter meeting. Hotel Statler, New York. R. C. Cross, secretary, 234 Fifth Ave., New York 1.

NOV. 28-*DEC.* 1—*9th Exposition of the Air Conditioning and Refrigeration Industry.* Convention Hall. Atlantic City. The exposition is sponsored by the Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W. Washington, D. C.

DEC. 10-17—*Nuclear Congress and Atomic Exposition.* Municipal Auditorium, Cleveland. American Institute of Chemical Engineers is the sponsor, Exposition director: Athel F. Denham, Atomic Exposition, 931 Book Bldg., Detroit 26.

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LOW VELOCITY UNIT COOLER FOR FOOD PROCESSING & STORAGE

Designed especially to conserve space, maintain proper temperature, produce even air motion, and reduce shrinkage. COLDMASTERS are ideal for multiple-unit installations. Available for ammonia, or for Freon, in galvanized or stainless steel.

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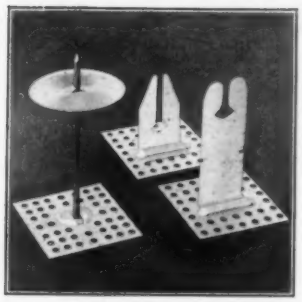

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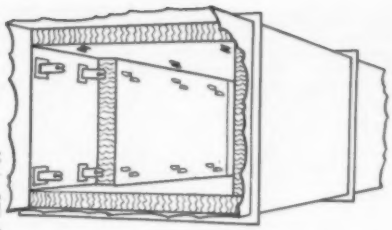

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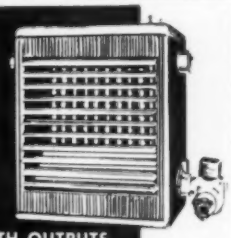

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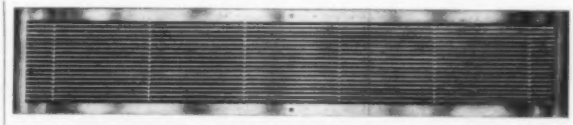

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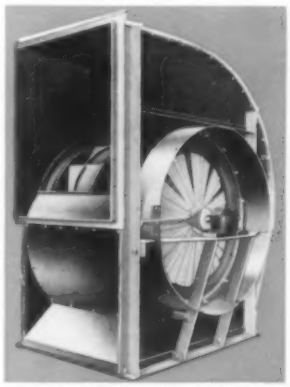

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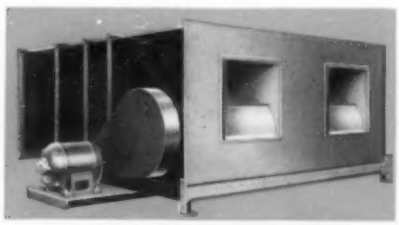

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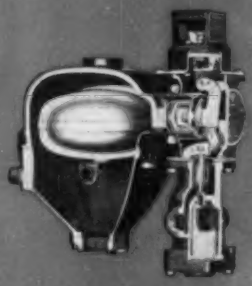

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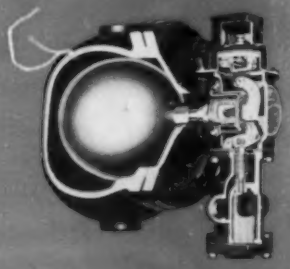

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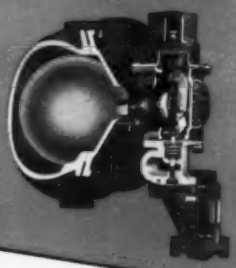

The primary safety device for a hot water space heating boiler is of course an ASME rated pressure relief valve. But it isn't the whole answer by any means.

It is a well known fact that a low water condition can occur in a hot water boiler just as it can in a steam boiler. The results are also similar—damaged equipment and costly repairs or replacements.

There are many possible reasons. Some of the more common are listed at right. New ones come to light all the time.

The only positive approach to the problem is to provide a float-operated mechanical means of adding water automatically when a low level condition occurs. An alternate solution is to interrupt current to the burner if the water level drops into the emergency zone. Best solution is a combination of both mechanical and electrical safeguards.

It is a solution that is rapidly gaining support on all sides. Many consulting engineers and utility companies recommend it. Many local codes and federal specifications insist on it.

So, for the best safety control on a hot water space heating boiler, include one of the McDonnell Feeder Cut-off Combinations shown here. They are the most widely used, time-tested devices of their kind.

For engineering data and selection chart write for Bulletin L-114.

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Doing One Thing Well

-here's why Hot Water Boilers need Low Water Protection

1 Relief Valve Discharge caused by overfiring

- Gas valve fails to close.
- Burner placed on manual operation.
- Failure of limit controls.
- Zoned system isolating boiler from distribution.
- Excessive carry-over of heat from hand-fired or stoker installations.

2 Loss of Water in distribution system

- Leaks in piping caused by expansion breakage or corrosion.
- Leaks through pump or other operating equipment.

3 Loss of Water due to carelessness

- Draining boiler for repair or summer lay-up without eliminating possibility of firing.
- Drawing hot water from boiler.

Your Jobber Stocks Them

McDONNELL *Boiler Water Level Controls*